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THE PROPOSED ELECTRICAL CODE OF WISCONSIN.

The State of Wisconsin, true to its progressive tendencies in recent years, is about to take an important step aiming at minimizing electrical life hazards. This is to be accomplished by the adoption of an electrical code, a preliminary draft of which has been made public and is published substantially in full in another part of this issue. A public hearing on this code is to be held at the State Capitol at Madison on March 13. Since the time for study of the matter is very short before this meeting and since the proposed code is the first one of its kind to be formulated by a state body and will probably, therefore, serve as a precedent for other states, it is desirable that electrical interests give immediate consideration to the subject.

At the suggestion of the Industrial Commission of Wisconsin, a committee of capable Wisconsin electrical men has studied this matter for several months and the proposed code is the result of its labors. The code is preceded by a number of definitions of electrical terms. The main part of the code consists of thirty "Orders for Safety in Electricity," which are to be promulgated by the Industrial Commission by virtue of legal authority granted it by the State Legislature. Without reviewing the proposed rules at length, it may be said that they deal for the most part with the safeguarding of circuits and apparatus for 300 volts and over, which are considered to be dangerous to life. They provide for the grounding of machine frames and conduits, also the neutrals of three-wire distributing systems where the voltage to ground does not exceed 150 volts; the grounding of transformer secondaries is not specifically required, however. Insulating gloves, mats, stools and similar safety appliances must be provided in practically all cases where dangerous apparatus or circuits must be handled. Nearly half of the rules relate to safeguards in overhead line construction. In general, the aim of the rules is to protect both employees and the public from electrical life hazards, this being done by broad installation rules suitable for general application.

Supplementing the main part of the code are three sets of more detailed rules for employees regarding the operation and maintenance of electrical equipment and general conduct in the vicinity of same. One set of these rules applies to wiremen, engineers, operators, helpers and oilers in electric stations, and substations; another is for linemen of overhead dis-

tribution systems; another set is for the employees of electrical departments in industrial plants. A final supplement consists of the now standardized rules for resuscitation from electric shock which were drafted primarily at the suggestion of the National Electric Light Association.

There may be some difference of opinion respecting the wisdom of promulgating an electrical code of installation rules when we already have a much more comprehensive and, on the whole, quite satisfactory set of such rules in the National Electrical Code, which is being recognized more widely every year as representing the best opinion of practically all branches of the electrical industry. Thus it is followed by engineers, architects and contractors throughout this country and Canada, and forms the basis for most municipal ordinances regulating electrical construction work. However, the evolution of the National Electrical Code from a set of fire-prevention rules has been rather slow and it was only recently that consideration of life hazard was taken into account in revising the Code. The bulk of the proposed Wisconsin electrical code does not supplant the National Electrical Code, but it supplements it by requiring numerous safeguards, partly in installation and partly in operation of electrical apparatus and circuits, to reduce the life hazard to a minimum. Thus its installation rules are aimed primarily at elimination of life risks. Its requirement of safety devices and its regulation of overhead construction are not touched on in the National Code.

The supplementary rules to develop the "Safety First" habit among employees, even though given in only tentative and not sufficiently general form, form the basis of an admirable code of electrical safety rules that should be adopted by every employer that uses electrical equipment exceeding, say, 300 volts, as the Industrial Commission seems to imply. The standard rules for resuscitation should be posted in every electric plant. Every effort should be made to further the safety movement and the plan of the Industrial Commission of Wisconsin to promulgate an electrical safety code should therefore be heartily commended.

THE MIDWINTER CONVENTION OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The scope of the activities of the American Institute of Electrical Engineers has been increasing rapidly in the past few years and one evidence of this is found in the constitution of the standing committees, which underwent a general revision under the present administration. Another evidence is the increasing number of meetings. These consisted formerly of the monthly gatherings in New York City and the annual convention held during the summer. Of late years such meetings have been supplemented by occasional gatherings in other cities and last year saw the innovation of a midwinter convention in New York City. It met with such success that the convention was repeated this year and is likely to become one of the regular annual events on the Institute program.

Last year's midwinter convention was held under the auspices of the Standards Committee and was chiefly concerned with matters affecting the revision of the Standardization Rules, which was then in progress and is still continuing. The convention this year was under the auspices of the Electric Power Committee, and again was a decided success, although comparing rather unfavorably in some respects with last year's convention. While the registration was somewhat larger than the total for last year's convention, the average attendance at sessions was not over 100, and the discussion was not marked with the virility, interest and weight which were so evident last year. Nevertheless a number of the papers were of much value and importance and much of the discussion was well worth while. A full report of the proceedings of the convention is given in this issue.

THE USE OF PROTECTIVE REACTANCES.

The discussion on the paper by Messrs. Lyman, Rossman and Perry was unfortunately somewhat incomplete. Anyone unfamiliar with the history of the development of current-limiting reactances might have concluded from the paper and the discussion that such reactances are panaceas for all operating ills. In fact the impression might very easily have been gotten by inference that it was more advantageous to put a given investment into reactances than into the bus structures. It is, of course, better engineering practice in large power stations to build in the switches and bus structures so solidly that a fault in this part of the system is a very remote possibility. Many bus reactances will then be found entirely unnecessary. This is rather well illustrated in the system of the Commonwealth Edison Company at Chicago, the experiences on which some five or six years ago first emphasized the need for current-limiting reactances, and where the pioneer installations of such reactances were made.

The generators in the power plants of this system have reactance coils or autotransformers for high reactance, but no bus reactances are used except in the tie lines between the Fisk and Quarry Street stations. These tie lines, having ample capacity and being very short, are practically extensions of the buses. The buses are thus divided into three sections through reactances, each section being connected to approximately 60,000 kilowatts in generating capacity. No feeder reactances are used, nor has the need for them as yet arisen in this system.

The paper referred to presupposes radial operation of transmission lines. It is a fact, however, that the

engineers of the larger systems are planning transmission lines in parallel at their receiving (i. e., substation) end as soon as protective relays for such operation give sufficient promise of success. Reactances between individual units would then, of course, be out of the question. The very interesting suggestion made by Mr. Stott has, of course, this same objection, that it makes parallel operation of transmission lines from different units impracticable. Feeder reactances may, in many cases, be desirable, especially as an aid to the better operation of protective devices, but their installation, particularly on feeders of existing plants, would in most cases be a rather expensive undertaking and one not easily carried out.

In general, while current-limiting reactances have a very real function and their use was thoroughly discussed by the authors, a warning should be sounded against "over reacting" and attention called to the fact that a proper design of the important parts of the system is usually better engineering than the addition of ameliorating devices which may render a poorly designed system fairly immune against disastrous wrecks.

THE FATIGUE OF PORCELAIN.

One of the important subjects brought up at the convention was the increasing number of failures of porcelain insulators on high-tension lines. The pronounced development of this feature of operation, which is attested by abundant evidence, has given rise to the idea that the material of which the insulators is made has undergone some change chemically or physically which results in a lowering of those mechanical and electrical properties which are essential to the best operation of the insulators and which have been assumed in their design.

Several of those participating in the discussion on this matter—men who have made a study of porcelain and its performance—expressed the opinion that porcelain which has been properly fired and completely vitrified does not undergo any change of this kind and that the failures have been due to the use of imperfect porcelain. This imperfect material may be in such a form that it is not disclosed by the ordinary test to which all insulators are subjected before installation on the line. Such imperfections may consist, for instance, of incompletely vitrified porcelain which is covered with a glaze which protects it from moisture, and its properties when new may be such as to withstand the ordinary tests. If, however, in the course of time cracks develop in the surface glaze, moisture may be admitted to the unvitrified material beneath and its properties will then deteriorate to the point where puncture results. If a method of test could be devised which would disclose the existence of such imperfect porcelain before putting it in service, it would be a great advantage to the users of this material and would obviate many future replacements.

THE EFFICIENCY OF VEHICLE TIRES.

The energy applied in driving an electric vehicle is expended in overcoming a number of mechanical resistances, such as bearing friction, air resistance, weight on up-grades, etc. Among the items which thus dissipate energy must be reckoned the tires, at least when these are not made of rigid material. With either the pneumatic tire or the solid-rubber tire there is a deformation of the tread of the tire as the weight of the machine comes upon it, and as the elasticity of the material is not perfect there is a transformation of energy into the form of heat, which goes to raise the temperature of the tire. This tire deformation is not merely a radial one nor a transverse one, but there is a displacement in the direction of motion as each point of the tread approaches the ground, and this gives the ground a wiping motion as the given point in the tire rises again. It is probably this motion which is largely responsible for the wear of the tire.

The amount of energy expended in the tire may vary greatly according to its material and method of manufacture. In this respect there may be great differences in different tires and the importance of this feature should be kept firmly in mind by vehicle users and vehicle manufacturers in selecting their tires. Until lately this feature of the electric vehicle has received little consideration, but manufacturers are now alive to the importance of the matter and are endeavoring to turn out tires which shall be as efficient as possible, with due regard to durability; since efficiency at a sacrifice of durability might result in the end in higher combined operating and maintenance costs.

Tests of tire efficiency have been largely neglected in the past, but the paper read last month at the meeting of the Electric Vehicle Association of America is evidence that this indifference is to continue no longer. Mr. Whitney has shown what can be done along the line of tire testing, and the accumulation of data of this description will not only be an aid to the purchaser of tires, but will help the manufacturer of them to develop a better product.

The question of tire efficiency is of importance not only to the user of the vehicle but to the maker of vehicles and the manufacturer of storage batteries as well. The more energy losses can be eliminated in any part of the operating mechanism, the farther can a vehicle operate with a given battery capacity; or the smaller the battery which will suffice for a given mileage. A reduction in battery size means at once a reduction in weight and this again means a greater mileage. Or again, the advantage may be utilized in the direction of increasing the load while the other conditions are kept the same. It is only by attention to all of the details which go to make up the greatest perfection of parts that the highest usefulness of the electric vehicle will be reached, and with each step in the evolution a greater success for the electric car will be attained and the more popular will its use become. Definite quantitative tests greatly aid such improvements.

Boston Teaming Problem.

A meeting of the New England Section, Electric Vehicle Association of America, was held at the Boston Edison Company's building, Boylston Street, Boston, February 25. In the absence of J. A. Hunnewell, chairman, Edward S. Mansfield presided, and introduced W. W. Scott, editor of *The Motor Truck*, Pawtucket, R. I., who spoke on the teaming problems presented in the city of Boston. From a map of the city, he discussed the transportation routes from terminals to business centers, pointed out the points of congestion and suggested some methods of alleviating them, and spoke of the relation of the automobile truck to the situation, specifying the various advantages of this type of vehicle, in smaller space requirement, facility of loading and unloading, and in economy of operation. Mr. Scott advocated a more general trucking at night.

Novel Electrical Exhibition by Ohio University Students.

Ohio State University, at Columbus, O., with a student body of over 4,000, is to have a novel electrical exhibition on April 16, 17 and 18. It will cover the whole range of appliances, from small household articles to electric locomotives and mining machinery. Manufacturers all over the country are being invited to take part. In addition to showing usual processes, all sorts of freak demonstrations will be in evidence. The enterprise is in charge of the students in the electrical department of the University.

New York Electrical Society Meeting.

The New York Electrical Society held its 326th meeting on the evening of February 27 at the new generating station of the United Electric Light & Power Company, at 201st Street, New York City.

President H. H. Barnes, Jr., called the meeting to order at 8:30 p. m. After routine business, an illustrated review of the history of alternating-current development in the city was given by Frank W. Smith, vice-president of the company.

H. W. Leech, electrical superintendent of the plant, then gave an illustrated description of the station. Following this the station was thrown open for inspection and guides took the visitors through all parts of the building.

Peoria Stormswept.

The recent heavy storm that passed over Illinois was more severe in and around Peoria than anywhere else. The storm started on February 22, and continued all night. The wind at times rose to a velocity of 38 miles an hour, drifting the snow into the cuts and stalling the cars of the Illinois Traction system at Allentown. Not a train left the Union Station in Peoria on Monday, as all trains were annulled for the day.

The telephone and telegraph companies did not suffer very much, as the snow was light and dry and did not stick to the wires. The city railway company had trouble, but by running sweepers all night was able to give good service.

Utah Electric Club.

At the regular luncheon of the Utah Electric Club at the Commercial Club, Salt Lake City, on February 26, J. E. Cosgriff, president of the Continental National Bank, discussed "The New Banking Law."

In clear and concise terms Mr. Cosgriff gave the members of the Electric Club a brief history of American banking institutions and compared them with those of European nations and pointed out how the new banking law will retain practically all of the advantages of the American de-centralized system of control and obtain practically all of the advantages of the European systems contralized control.

Coming Meetings of Electrical Engineers.

The thirty-first annual convention of the American Institute of Electrical Engineers will be held in Detroit, Mich., June 22-26, 1914. Convention headquarters will be at the Hotel Cadillac. The Meetings and Papers Committee requests that authors desiring to present papers at this convention will notify the committee to this effect promptly and submit their manuscripts before April 1.

The 292nd meeting of the Institute will be held in the Engineering Societies Building, New York City, March 13. The meeting will be under the auspices of the Telegraphy and Telephony Committee, and the Institute of Radio Engineers will participate in this meeting.

Three papers will be presented: "A Comparison of the Telegraph with the Telephone as a Means of Communication in Steam-Railroad Operation," by M. H. Clapp, superintendent of the Northern Pacific Railway Company; "Traffic Studies in Automatic Switchboard Telephone Systems," by W. Lee Campbell, general superintendent of the Automatic Electric Company, Chicago; "The Goldschmidt System of Radiotelegraphy," by E. E. Mayer.

Other meetings will be held in Pittsburgh, Pa., April 9 and 10; Washington, D. C., April 24 and 25; Pittsfield, Mass., May 29.

Exhibit of Physical Apparatus.

In connection with the joint meeting of the American Institute of Electrical Engineers and the American Physical Society, to be held in the new electrical laboratory of the Bureau of Standards, Washington, D. C., on April 24 and 25, it is planned to have an exhibit of physical apparatus. The necessary arrangements will be made by a local committee, of which S. W. Stratton is chairman, appointed by the president of the American Physical Society.

The main purpose of the exhibit is to present an opportunity for those interested to inspect and see in operation new apparatus which is available from manufacturers or which has been arranged by those engaged in research. The exhibit will be limited to recently developed lecture, laboratory and research apparatus, together with illustrative photographs, charts, etc. Similar exhibits have been prominent and interesting annual features of physical societies abroad. Exhibits may be made by manufacturers and dealers in apparatus, by universities and other laboratories, and by individuals whether members of the Society or not. Applications should be made at once to the secretary of the committee, F. A. Wolff, Bureau of Standards.

Peoria Electric Club.

The Peoria Electric Club held its semimonthly meeting and luncheon at the Jefferson Hotel at 1 p. m. on Saturday, February 28. There was a good attendance. A musical program, in which the members joined in the singing, was given. Buck Ahrends gave a good talk on the development of the incandescent lamp, starting at the old carbon-filament lamps and continuing down to the half-watt Mazda. He exhibited a sample of the nitrogen-filled lamp.

A rejuvenation will be held at Peoria on March 13 and a good class is in sight for initiation into the Jovian Order. The evening of the same night the club will give a dance.

Electric Club of Chicago.

At the meeting of the Electric Club of Chicago on February 26, T. B. Lambert, of the Chicago Telephone Company delivered a very interesting address on Mexico, illustrated by lantern slides.

Preceding the meeting President Bone was presented with a solid-gold fob as a reward for his efforts in securing new members. A. A. Gray made the presentation speech.

The names of ten new applicants for membership were read at the meeting.

Electricity in Moving-Picture Plants.

Little conception is had of the magnitude of the moving-picture industry from the producing standpoint, although taken altogether it ranks among the most important industries in the country. The complete electrical equipment of the Selig Polyscope Company's establishment is described in this article.

The marvelous, universal popularity of moving pictures is one of the wonders of the present age and, likewise, the scientific development necessary to make the production of moving pictures possible on the present scale ranks with the achievements in other rapidly developing industries. The countless thousands who daily view moving-picture plays have but little conception of the magnitude of the industry, from the producing standpoint, or of the work and equipment involved in taking even the most modest pictures.

From the electrical standpoint it can be stated without fear of contradiction, that no other single element contributes more to the success of the business of producing than electricity. Without artificial light, permitting work to be carried on day and night and under any weather conditions, the business would be seriously handicapped. Also, electric power is indispensable in the studio for operating perforating machines, printing machines, fans, etc. Before taking up a detailed description of a modern plant, it may be of interest to comment briefly on some of the more important operations carried on in the typical American studio.

It may be stated, by way of introduction, that the idea of producing apparent animation by means of pictures is by no means new. The origin of the most primitive form of moving-picture device is lost in the mists of antiquity, but it is certain that long before photography was conceived animated pictures were in vogue.

It seems, according to a book on moving pictures by F. A. Talbot, that the development of the industry really dates from the perfection of the continuous celluloid film, by Mr. Eastman, in 1889 and the almost co-incident development of the "kinetoscope" by Thomas A. Edison. This was the first commercial appliance to show pictures in natural movement.

Without going into a description of the manufacture of films it may be of interest to state that one firm alone, the Eastman Kodak Company, produces over 7,300,000 lineal feet of film per week. The principal ingredients of the film are gun cotton and alcohol.

Scene Set in Main Studio of Selig Polyscope Company, Showing Quartz-tube Lamps Above and Banks of Lamps on Sides.

The studio receives the film from the manufacturer, generally in lengths of 165 feet which is approximately the capacity of the average film box. Before it can be used in the camera it has to be perforated on either side in order that successive areas of film 0.75 inch deep can be siezed and brought into position behind the lens. This perforation is of an elongated form, measuring about one-eighth of an inch in width by approximately one-sixteenth of an inch in depth. There are 64 perforations to the inch.

The preliminary operation is carried out with a machine which stamps the holes by means of specially hard-

ened steel punches. Extreme care has to be taken to carry out the task with mathematical accuracy, in order that the film may be used with any type of camera and projector. Without it steadiness of the picture upon the screen is absolutely impossible.

As this operation has to be carried out in the dark room in the dim light of a ruby lamp, it is imperative that the machines should be of the most simple design and operation, demanding the minimum of labor on the part of the operator. Electric motors have come to be the most satisfactory and economical method for driving these machines and are now universally employed.

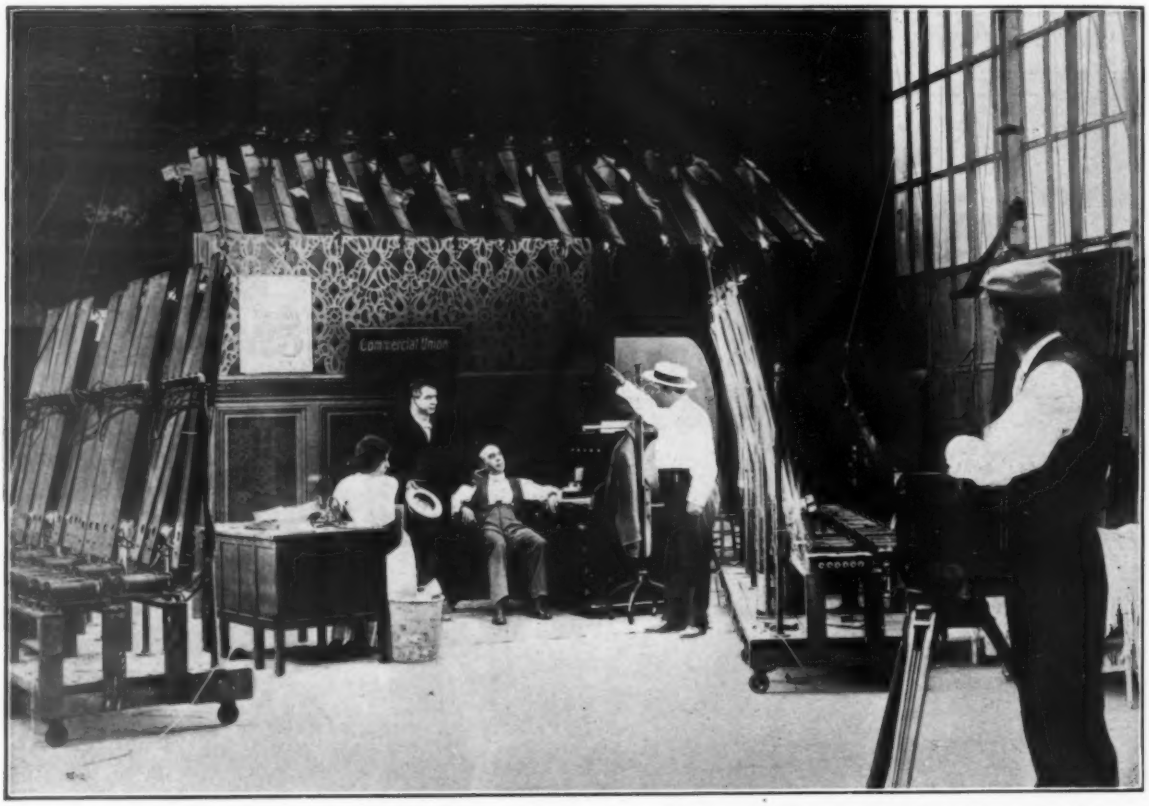
From the perforating machines the films are used in the camera, and the developing and printing are the next operations where electric power are employed. As may be supposed different factories employ different methods in carrying out these operations, particularly developing. A film may be 300 to 400 feet long, and consequently special practice is necessary. In some establishments developing is carried on on an extensive scale, the films as withdrawn from the camera film box being wound at once upon a large wooden reel, seven feet or so in length, suspended upon brackets above the developing bath. When the drum has received its full length of film it is lowered into a deep tank containing the desired solution, and then kept revolving slowly until the treatment is completed. The film when developed is then wound on a drying drum. In addition to motor-driven pumps, electricity is used in the developing room for handling films on the drums mentioned, and, of course, motor-driven fans are relied upon to furnish drying breezes in the dry room.

When completely dried the film is then ready for the printing machines. Printing is carried out by contact, that is the sensitized surface of the positive film is pressed tightly against the emulsion side of the negative film at the instant the exposure is made. The various printing machines used all work on the same principle, namely, unwind both the negative and positive films, bring the two together at the aperture admitting the light and rewind both films after contact has been made. Printing speed, of course, varies according to the density of the negative and the intensity of the light and for this reason individual motor drive, using a direct-current variable-speed motor is recommended. The power required by printing machines is approximately one-twelfth horsepower.

The intensity of light is varied by mounting the lamp on an adjustable frame which is controlled by the operator. Concentrated-filament Mazda lamps are being exclusively used for printing purposes.

In the modern studio or plant many motor uses will be found in addition to those already mentioned. Perhaps the best exemplification of present-day practice in this regard will be found in the modern establishment of the Selig Polyscope Company, of Chicago.

When moving pictures made their bow to the public the latter were satisfied with the reproduction in animation of scenes and incidents associated with every-day life. But the popular taste changed in the course of time. The audience became fastidious, and demanded novelty. There was a clamor for picture plays and the public saw no reason why dramas, tragedies, comedies, etc., should not be produced. This popular demand was by no means easy to meet. Obviously plays could not be photographed upon the ordinary stage of the theater owing to difficulties of lighting. Open air theaters were then constructed but again difficulties were en-



Selig Studio Showing Use of Mercury-Vapor Lamps on Sides and Overhead. Quartz-tube Lamps Are Now Used Above.

countered as the taking of pictures then depended upon favorable weather conditions. From these makeshift affairs the studio has developed to its present proportions, when plays of practically any magnitude can be staged. It is difficult to realize the proportions which these plants have attained.

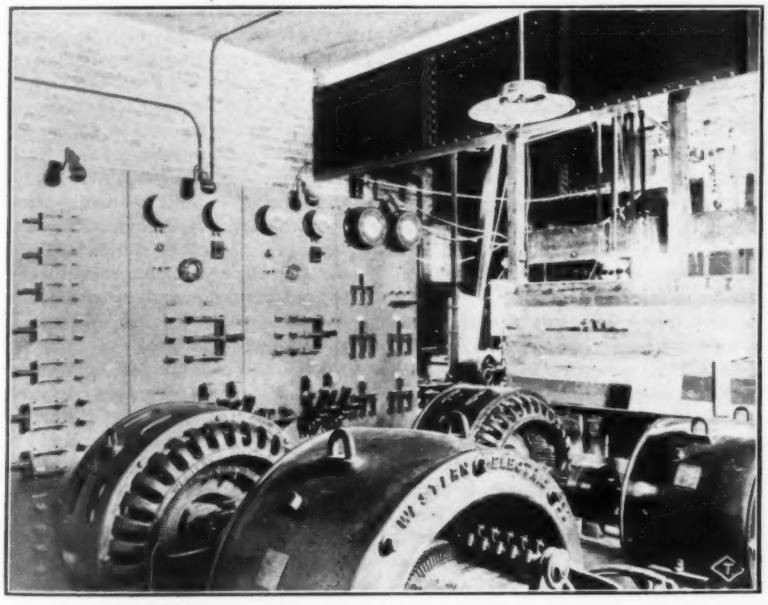
The Selig plant in Chicago is especially noteworthy owing to its great size and the remarkable plays it produces. It is devoted exclusively to making films and employs in excess of 400 hands.

The main studio in which there are two stages, measures 179 feet in length by 80 feet wide. The large stage is of sufficient size to permit of 7 or 8 scenes being set at one time. In addition to this indoor establishment there are between two and three acres of surrounding land which have been inclosed for outdoor work.

The Selig organization is one of the largest in the United States, having, in addition to the Chicago establishment, another theater at Los Angeles, Cal.

Of course the lighting is the most important feature in the studio. While the inherent advantages of daylight for photographing must be admitted it is a fact that in many of the studios artificial lighting is depended upon entirely. This is due to the fact that with uniform artificial light the photographer can obtain uniform results, knowing exactly what length of exposure must be made. Sunlight is decidedly variable and frequently costly delays in photographing a play have been necessary because of clouds, etc.

Main Studio Building at the Selig Plant Showing Glass Top and Side.



Substation at Selig Plant. Four Motor-Generator Sets Are Installed.

In the Selig plant the studios are arranged so that photographing can be done by natural or artificial light, or both. One of the accompanying illustrations shows the exterior of the studio building and it will be observed that the roof and one entire side is of glass.

The artificial lighting equipment comprises quartz-tube and mercury-vapor lamps, manufactured by the Cooper-Hewitt Electric Company. Of the former there are 15 in each studio. In the large studio these lamps are hung from a traveling frame, the base of the lamps being about 10 feet above the floor. The tracks for the frame are arranged along the center of the room so that the lamps can be placed over any desired scene. Each of these lamps gives approximately 4,500 candlepower directly underneath. The lighting of the quartz lamps is supplemented by banks of mercury-vapor lamps arranged on portable frames, 10 800-candlepower lamps to the frame. Usually four of these frames are employed, two being placed on each side of the scene being photographed. The tubes of these lamps are 50 inches long and they are placed in a vertical position, arranged to be raised or lowered as occasion demands. The combined light from all lamps approximates 100,000 delivered candlepower, which is the amount necessary to give the desired intensity.

Portion of the Property Room at Selig Plant.

Leads from the main supply feeders are run to portable distributing boxes where connections are made for the various banks of lamps. The boxes as well as the banks of lamps are on rollers and can be easily moved to any desired location.

The lighting equipment of both

studios is exactly the same. In both cases spot lights are employed when scenery or other obstructions would prevent both sides of the stage to be illuminated by the mercury-vapor lamps.

The types of illuminants used at the Selig establishment are admirably suited for the work in question because of the uniform distribution of light, preventing the shadows inseparable from the sun light; because of the actinic quality of the light; low intrinsic brilliancy; and its steadiness and uniformity. Performers working in this light continuously for a number of years have been caused no ill effects which is not true when arc lamps are used.

One of the important features of any moving-picture studio is the property room. One corner of this department at the Selig plant is shown in one of the illustrations. Two motors are used in the woodworking shop where a full equipment of woodworking machines will be found. Cannon, battleships, houses, and countless other articles are constructed and the feature that impresses the visitor most is the permanent construction of these various articles, although they play but a small part in sometimes only one scene of a single production.

A completely equipped machine shop also forms part of the equipment of the Selig factory and in this shop cameras are constructed and all machinery repaired. One five-horsepower motor drives a line of shaft to which is connected most of the machines, while a milling machine, lathe and drill press are individually driven by two-horsepower direct-current motors.

Other motors are used for operating pumps, elevators, ventilating fans and miscellaneous apparatus. There are 30 one-twelfth-horsepower motors driving printing machines and two 1.5-horsepower motors drive two batteries of perforating machines.

Energy for all purposes is purchased from the Commonwealth Edison Company and converted from alternating to direct-current by means of motor-generator sets, as direct current is required throughout the plant, for all but a few of the machines.

There are three sets installed, one comprising a 150-horsepower induction motor direct-connected to a 100-kilowatt generator which supplies energy for the lamps. The other two sets comprise 60 and 75-horsepower motors direct-connected to 40 and 50-kilowatt direct-current generators, respectively.

Commercial Practice
Management, Rates, New Business

PLANS FOR SECURING NEW BUSINESS IN SMALL CITIES.[1]

By H. G. Bonner.

This subject is so broad that it is impossible to mention, much less describe in detail in a paper of this kind all possible plans for securing new business. The object of this paper is merely to hit some of the high spots of this question and to describe in detail only one definite plan, a wiring campaign for already built houses not equipped for electric service.

The question today is not shall central stations in small cities have a sales department, but rather what methods shall this department use to get up the best results. This is the age of system, and while too much red tape is almost as bad as none at all, the best results can not be expected if the central-station's representatives are simply assigned a territory in which to work and are then turned loose in this territory by their manager with the simple instruction of "get the business" First of all, the new-business department should be thoroughly organized under a new-business manager who should have entire charge of this work. Even if there are only two men in the department one of them should be at the head.

There are two general classes of business, lighting and power. These are subdivided under other headings, such as residence lighting and commercial lighting. Commercial lighting is also subdivided into several classes, such as store and window lighting, sign and outline lighting, etc. The first step therefore in planning a campaign for new business is to find out exactly how much of each class of business is available and then map out a definite plan for securing each class. There is only one way to secure this information on which the new-business manager must base all his selling plans, and that is by a house-to-house canvass. The city should be divided into territories and a representative assigned to each territory. He should go from door to door and get complete information on each house, store, etc. This information should include the street and number and name of the occupant of the building, the name and address of the owner, whether the building is located on the distributing lines of the company or not, the use to which the building is put, that is whether it is a residence, dry goods store, etc., whether it is wired, whether electric service is used, if not what illuminant is used and if electric service is used, what lighting equipment and appliances are in use, etc. In short he should get all the information that may be of any value in future selling campaigns. The representative should keep this information for his personal use in a loose-leaf book containing printed forms for recording this information and each evening should transfer the information secured during the day to cards, using a separate card for each customer or prospect. These cards should be kept by the new-business manager and when completed give a complete card index of the entire city. It is, of course, rather expensive to make a complete canvass in this manner but usually the representative will be able to sell enough irons, etc., to present customers to largely off-set their expense, and the canvass when completed is a mine of information that is invaluable. Right here let me state that these canvass books and cards should always be kept up to date, for if they are not they will soon become of litle value. A canvass of all the industries should also be made and detailed information secured on the kind of power used, the approximate horsepower, method of drive, names of officers, etc.

All canvass cards should be divided into two classes, customers and prospects, and the latter into three general classes, i.e., industrial residence and commercial. The residence cards are then divided into three classes, those

1 Paper presented before the Toledo meeting of the New-Business Committee, Ohio Electric Light Association.

not on the distributing lines of the company, houses on the lines owned by the people living in them and rented houses on the lines. Each of these classes should be filed separately with a street index. This may seem rather complicated but while it requires considerable work, when completed this canvass is the foundation upon which is built the superstructure of systematic selling plans.

Taking up first residence lighting, a system that has proved very successful is as follows:

The first step is to adopt a schedule of prices for wiring old houses. The central station here has one of two courses to follow; either to go into the house-wiring business itself or else secure the co-operation of the local wiring contractors. If at all possible the later scheme is very much the best. In Elyria we have followed the system that has proven so successful in Cleveland and Toledo. The various responsible wiring contractors have a schedule of prices for wiring old houses. Of course our prices are lower than in the cities mentioned, as work is done more cheaply in a small city. It is the central station's duty to see that these prices are as low as is consistent with good work and a reasonable profit for the contractor. The wiring schedule should provide for a small payment down and the balance in say ten equal monthly installments, with a cash discount if the whole amount is paid on the completion of the work. When the wiring schedule has been adopted, a set of cheap but good fixtures should be selected and photographs of these fixtures, with price list should be mounted in a small folder for use by the representatives. This folder, a list of prospects and a bunch of wiring contracts which contain the wiring schedule are all that the representative needs to carry.

The wiring schedule, fixtures, etc., should be decided upon while the representatives are making the canvass so that when it is completed an active house-wiring campaign may be begun.

The first step in this campaign is to make up three mailing lists from the canvass cards. These lists are first, home owner's list; second, renter's list, and third, landlord's lists. A series of three form letters should be prepared for each of the three classes. The advertising appeal to each class is of necessity entirely different. The home owner should receive letters relative to the safety, convenience and cleanliness of electricity. The tenant should be requested to speak to his landlord relative to having the house wired. The landlord should receive letters telling him the advantages of an electrically equipped home, from both a renting and selling point of view. With each letter should be inclosed a return post card which when filled out by the prospect will be a request to have a representative call at a certain address at a certain time, to explain the details of the wiring plan and to give an estimate. A small piece of advertising matter, such as is put out by our friends, the lamp manufacturers, should also be inclosed.

It is recommended that each piece of advertising matter be mailed approximately one week apart preferably the first of the week.

It is recommended that one-cent postage be used, the letters not being sealed. It has been ascertained by experienced advertisers that where letters are sent to residential prospects one-cent postage is as effective as two-cent postage.

A call made by one of your representatives after the advertising material has been mailed is very important in this campaign. Otherwise the direct results obtained from the advertising matter unassisted by personal solicitation may be discouraging. The advertising matter serves merely to introduce your proposition to the prospect and to arouse his interest. In accomplishing this it opens up the way for a personal interview by your salesman.

Striking and effective window displays will be found to contribute very materially to the general success of the campaign.

Newspaper advertising in this campaign is thoroughly recommended. It is advisable that an advertisement appear two or three times each week in the leading newspapers. I would suggest that the size of the advertisements be two columns wide and eight or ten inches deep.

During the house-wiring campaign, and in fact at all times, morning meetings of all the representatives should be held. These meetings should be short and to the point. It is a well known fact that the morning is the best time for new-business work, and the object of these meetings should be to send each representative out on his territory not later than 8:30 a. m. filled with enthusiasm and a determination to bring back at least one order before the day is done. Nothing succeeds in any sales work like enthusiasm. In the small city there will be only a few representatives and these morning meetings give the manager an opportunity to train his men and take up with each one individually his work and results and to advise him regarding his problems.

It should be borne in mind in this house-wiring campaign that the main object is to get old houses wired and using service and not to sell fixtures, and where the prospect wants more of a selection of fixtures than the one set the representative can show him, the proper method for the representative to follow is to secure the wiring contract and advise the customer where to go to get better fixtures. If such a prospect is tipped off to a fixture dealer, the dealer will be glad to follow it up.

So much for old house wiring. A sales system of this kind once started may be kept going indefinitely and the number of lighting customers will grow in proportion to the energy spent as each new customer is another advertisement.

A similar campaign may be worked out for store lighting. In this case, however, it will be found impracticable to attempt to adopt a wiring schedule. It will also be necessary to depend more on newspaper advertising and personal calls than on circular letters to arouse interest in this line. Good snappy businesslike letters with two-cent postage, however, will help a lot to arouse interest among the merchants.

Sign and window lighting should come in for a great deal of attention and a very determined effort made to get this class of business, as it is highly profitable long-hour business and does much to advertise electric service to all classes of prospects. The proper method of procedure is to adopt a flat rate for dusk to midnight service for such installations, the company to turn on and off the lights, and furnish lamp renewals. As this is advertising lighting only, this puts it on a strictly advertising basis and you can approach your prospect with a definite dollars and cents proposition. An experienced lighting solicitor can handle interior and show-window lighting, but sign business is a class by itself and requires special training.

In most small cities it will be found necessary to train one or more of the representatives in this work. In this training and in subsequent sign work, much help can be secured from the sign builders. The electric sign builder is, of course, looking for business and will gladly send one of his salesmen to any city where there are prospects of getting business. The central station should not expect the sign manufacturer to do all the work, however. There should be a list of live prospects for the sign salesman to work on when he makes his first visit to your city.

The representative who is to be trained in this work should go with the sign salesman in calling on these prospects and in this way absorb some of the sign salesman's experience. In a short time he should be able to handle

this work entirely except for the actual making of finished sketches and working up quotations on the cost of the signs themselves. All that is necessary in this regard is to send the sign manufacturer an idea of the type and price of sign that the prospect needs and from the designs that the sign builders submit, the representative can sell the signs.

With regard to sign designs, these should be original. If John Smith puts up an electric sign that is novel and atractive, his competitor will want a better sign. If, however, John Smith buys a sign that is like hundreds of others all over the country, it would be pretty hard to sell his competitor one like it.

Much has been said on the power question and it is useless for me to attempt in a paper of this kind to lay down any rules for getting this business. It is a question of salesmanship pure and simple and to get results must be handled by a power salesman. In the small city, this usually means that the new-business manager must be able to handle this work.

Much of the central station's success depends on its dealings with the public. Fair and courteous treatment of customers at all times, by all employees, will do more toward the success of the new-business department of any central station, large or small, than any other one thing.

Newspaper advertising should be freely used. The central station in a small city cannot afford the services of a special advertising man and consequently the new-business manager should handle this and give it careful attention. The advertisements should be carefully written and copy changed frequently. Make your advertising distinctive. It is advisable to use cuts in your newspaper advertisements. Good cuts may be obtained from the various manufacturers of electrical apparatus and from some of the advertising agencies, but the reading matter, which usually accompanies such cuts should be rewritten to suit local conditions. Avoid "canned advertising.' The central station should strive for the reputation of being the smartest advertiser in town.

Safety Meetings in Indiana.

The United Gas & Electric Company, New Albany, Ind., organized safety committees among its employees at a meeting February 27, at which James Harmon, in charge of safety work for that company and associated corporations, was in charge. Discussions of ways to handle electric shocks and asphyxiation will be given a prominent place by the committees, and at the next meeting the use of the pulmotor will be demonstrated.

New-Business Men Hold Convention in Toledo.

A very profitable and enthusiastic meeting of Ohio new-business men was held at Toledo, on February 25, under the auspices of the Committee on New Business Co-operation of the Ohio Electric Light Association. This was the first of a series of three meetings to be held by this committee and over 100 were in attendance, including many contractors who were invited to participate.

Sessions were held in the morning and afternoon with Thomas F. Kelly, chairman of the committee, presiding. The first session was called to order promptly at 10 a. m. and Frank P. Coates, president of the Toledo Railway & Light Company, called upon for the welcoming address.

H. G. Bonner then presented a paper entitled, "Plans for Securing New Business in Small Cities." This paper is published elsewhere in this section. The discussion resolved itself into an experience meeting which lasted until noon.

Lunch was served at the Elks Club, where the meetings were held, following which Ben Baum, of the Toledo Railway & Light Company entertained the visitors with a monologue. George Hardy, secretary of the Toledo Commercial Club, then addressed the gathering, laying particular stress upon the part the Toledo utility takes in civic affairs and in boosting the town. Mention was also made of the slogan sign which the company has recently donated to the city.

The afternoon session was convened at 2 p. m. and a paper by P. L. Miles, of the National Lamp Works, entitled, "How the Electrical Manufacturer is Prepared to Assist the Electrical Contractor in Large or Small Cities, and Suggestions Whereby Through the Co-operation of the Electrical Contractor and Central Station New Business can be Secured," was presented. Mr. Miles considers a house-wiring campaign as an example, and shows how the co-operation between contractor and utility is essential if the greatest amount of business is to be secured. Many excellent suggestions were advanced for co-operative advertising, window displays, etc.

A paper by E. L. Callahan of Chicago, entitled, "Suggestions to Assist Central-Station Salesmen to Secure New Business," was postponed until the April meeting because of Mr. Callahan's absence.

The next meeting will be held in Dayton early in April and another will be held in Cleveland during the Electrical Show there. T. F. Kelly, of Dayton, will have charge of all arrangements.

The following were in attendance at the meeting:

Thomas F. Kelly, Dayton Power & Light Company; D. L. Davis, Salem Electric Light & Power Company; Otto E. Wessel, Columbus Railway, Light & Power Company; Dean Emerson, Wagner Electric Manufacturing Company; Charles A. Roberts, United Service Company; H. V. LaBar, Toledo Railway & Light Company; R. H. Wright, The Cleveland Electric Illuminating Company; E. R. Gillet, F. Bissell Company; P. L. Miles, National Lamp Works; W. S. Bissell, F. Bissell Company; L. C. McKenzie, Toledo Railway & Light Company; J. E. North, Springfield Light, Heat & Power Company; G. H. Oliver, J. H. Paff, Emil Grah, Western Gas Fixture Company; Earl F. Miller, Earl F. Miller & Company; E. Garland, C. T. Beck, Federal Sign System; H. E. Adams, The W. E. Nagel Electric Company; A. K. Young, J. J. Cooney, David E. Nims, Toledo Railway & Light Company; H. C. Warren, Toledo & Indiana Railroad; S. F. Messer, Kent Water & Light Company; F. R. Fox, Toledo & Indiana Railroad; H. W. Brook Westinghouse Electric & Manufacturing Company; C. E. Mattison, Toledo & Indiana Railroad; F. M. Knierim, F. Bissell Company; F. E. LaFrance, LaFrance Electric Company; Fred M. Schafer, Electrical contractor; Ear H. Cobb, Toledo Railway & Light Company; James M. Darst, A. M. Seeger, C. Felker, Charles Bay, Ned Braunschweiger, James Fagen, Robert H. Carson, T. B. McMillan, Fred C. Cory, Lewis J. Lemen, Joseph K. Bauer, F. J. Boyle, Charles A. Huber, James L. Stone, N. F. Corcoran, Toledo Railway & Light Company; W. B. Wilkinson, The Ohio Light & Power Company; G. T. Groff, Groff Electric Company; F. E. Morrison, Ohio Light & Power Company; H. L. Montgomery, Ohio Light & Power Company; P. A. Staples, Sandusky Gas & Electric Company; E. R. Kelsey, Ben Baum, Toledo Railway & Light Company; L. C. Anderson, Middletown Gas & Electric Company; L. C. Anderson, Franklin Electric Light Company; R. C. Heston, Toledo Railway & Light Company; A. A. Pointer, Antwerp Electric Plant; W. J. Young, Toledo Railway & Light Company; C. M. Lott, Hicksville Electric Light Company; A. G. Hester, Toledo Railway & Light Company; E. A. Geauque, Edgerton Light Company; Augustus Kneisel, Toledo Railway & Light Company; G. F. Evans, Columbus Railway, Power & Light Company; J. W. Cushman, Fostoria Lamp Works; Fred Bissell, F. Bissell Company; H. G. Bonner; and B. Baker.

Electric Sign Data

Recent Noteworthy Sign Installations.

The Turner Moving & Storage Company, Denver, Colo., has installed an electric sign on the top of its office and warehouse, 135 feet above the ground. The field is of wire attached to an iron frame 40 by 40 feet. The sign contains 1,800 lamps in three colors.

The central figure, in white, represents the world revolving on its axis, within which the outlines of the Western Hemisphere are shown in red lights. Around the border, alternating with the lights in the central symbol, streaks of forked lightning dart out in zig-zag form; a close imitation of natural forces in action.

During the intervals between the other colors, green lights in each of the four corners flash out the company's address, telephone number and the slogan, "The World Moves, and So Does Turner."

The Davis & Shaw Furniture Company, also of Denver, have placed a unique electric light sign upon the roof of their building. The sign is 54 feet high, by 37 feet wide and contains 1,204 lights in six colors.

The central figure of the sign represents a lady seated in an easy chair, rocking to and fro, surrounded by evidences of luxury and refinement. Lights forming the name Davis & Shaw, are extinguished and relighted in a manner that suggests a group of school children rushing to their places in a favorite game.

Around the margin, lights are so arranged that the effect of the combination, as viewed by the spectator on the sidewalk, is that of a painting set in a heavy, gilt frame; the inner edge of which is interwoven with scrolls, wreaths, and filigree.

In Tennessee the Nashville Railway & Light Company and the Herbrick & Lawrence Company, a contracting firm of Nashville, Tenn., are working on an electric sign campaign in conjunction with the Federal Sign System (Electric), which is handling the matter from its offices in Louisville. The development of electric sign business in Nashville has been rather backward, but with the energetic efforts which are being made it is expected that a large number of new contracts will be added in the near future.

In Buffalo, N. Y., work is progressing on what is claimed will be one of the largest temporary electric signs ever erected in the United States. It will be erected on the roof of the Elmwood Music Hall and will advertise the Buffalo Electric Show to be held the week of March 9-14, in this building. The sign will stand 24 feet high by 40 feet wide.

A border consisting of 800 25-watt lamps will inclose the entire sign. The wording of the sign is "Electric Show," in script letters 10 feet high. About 1,200 25-watt Mazda lamps are used.

It is said by the builders that as far as the eye can reach the sign will be perfectly readable. The sign, because of its intense brilliancy will mark the location of the show from all parts of the city.

The design submitted this week is of a sign erected by the Sterling Electric Company, of Minneapolis, Minn., for its own use. It illustrates in a striking manner how electric signs can be used to advertise a trade mark, the sign in question being a reproduction of the Sterling Company's emblem. The central portion of the design represents a rapidly revolving motor. The sign is so connected that when the words, "Sterling Electric" are not burning the black spots travel and look as though they were spokes.

Sign of the Sterling Electric Company, Minneapolis, Minn.
Dimensions, 10 feet high, 9 feet wide.
Motor is outlined with a circle of lights covered with green color caps. Operated by a flasher giving effect of revolving. The words, "Sterling Electric" have white color caps and "Company" red.
There are 400 10-watt lamps used.

Electrical Construction

PROPOSED ELECTRICAL CODE OF THE STATE OF WISCONSIN.

Rules to Insure Safety in Electrical Installations.

The Industrial Commission of Wisconsin has for several years been making very successful efforts to promote the safety of employees in industrial establishments of all kinds throughout the state. The Commision is an official state body created through legislative enactment; its members are C. H. Crownhart, chairman, J. D. Beck and Fred M. Wilcox; its secretary is Paul J. Watrous; its headquarters are at Madison, Wis.

Feeling the need of some concerted effort to minimize the dangers to life from electrical circuits and apparatus, the Commission asked a committee of prominent Wisconsin electrical men representing various interests, to consider the question and draw up a set of rules in the nature of an electrical safety code. These rules have not yet been officially adopted; a public hearing is to be held at which they will be considered. As far as known, this is the first code of this nature proposed by a public body. To give it publicity among electrical men it is therefore published below practically in full as made public by the Commission.

Introduction.

The following tentative rules governing the installation and maintenance of electrical equipment in the state of Wisconsin have been drawn up by the following committee:

Thomas E. Barnum, Cutler-Hammer Manufacturing Company, Milwaukee.

Charles Dietz, Commonwealth Power Company, Milwaukee.

W. F. Gute, Milwaukee Federated Trades Council, Milwaukee.

Walter Nield, Illinois Steel Company, Milwaukee.

P. A. Schroeder, Henry Newgard Company, Milwaukee.

S. B. Way, The Milwaukee Electric Railway & Light Company, Milwaukee.

C. W. Price, assistant to the Industrial Commision, Madison.

The committee has given several months of careful study to the subject and has consulted all the available authorities in order to fix a Wisconsin standard. It is the desire of the committee and of the Industrial Commission, however, to afford ample opportunity for the offering of suggestions and criticisms that will make the code more perfect. To this end manufacturers and all other interested persons are invited to attend a hearing on this proposed electrical code. This hearing will be held in the rooms of the Industrial Commission in the Capitol at Madison, at 10 o'clock on March 13, 1914.

The procedure for carrying the electrical rules into effect will be issued when the Industrial Commission issues its general electrical rules after public hearing. This procedure will be adopted under the authority conferred upon the commission in Chapter 485, Laws of 1911, and Chapter 587, Laws of 1913.

The Industrial Commission wishes to acknowledge its sincere thanks for the conscientious and patient work of the electrical committee, each member of which has attended practically all of the meetings, running through several months, and all of whom will be recognized as competent experts on the subject.

PROPOSED ELECTRICAL CODE.

Definitions of Terms.

Alive and Live. Terms that mean "charged with electricity," and are used in speaking of conductors, circuits, and machines that are in a condition to give an electric shock.

Automatic. A term applied to devices and equipment to denote mechanical instead of manual control.

Dead. A term used to denote that any part of an electric circuit or apparatus is not in operation or is not charged electrically.

Electric Circuit is a system of electrical conductors joined together so that electric current may flow through them.

Exposed to Contact means that an object is not insulated, located or guarded in such manner as to prevent accidental contact by workmen in the ordinary course of employment.

Grounded. A term used to denote that an electrical conductor or machine is electrically connected to ground. Such connection may be permanent or accidental.

Guarded means so covered, fenced or enclosed that a person in the course of his employment is not liable to come in contact with the point of danger and be injured.

Isolated. A term which means that a thing is so placed apart or separated as to be alone and out of the way of persons while in the course of their employment.

Insulation. A material which is a nonconductor of electricity and which will prevent the flow of an electric current. Insulation is employed to surround or cover conductors for the purpose of preventing the escape or leakage of electric current.

Insulated. A term used to denote that apparatus or conductors have been separated or covered in a manner to prevent a flow of electric current at the rated voltage of the apparatus.

Manual. A term used to denote that a device requires to be manipulated by the effort of the operator or workman.

Master Controller. A device, such as a push button or switch, used for operating main controlling apparatus and by means of which such controlling apparatus is made subject to the will of the operator.

Motor Control Boards, or Motor Controlling Switchboards. Terms used to denote manual or automatic devices employed in the control of electric motors.

Panel Board. A small switchboard controlling inside distributing circuits.

Remote Control Apparatus. Apparatus for controlling electric equipment which is remotely situated from the point of manual operation or control.

Secondary. A term used in referring to a circuit in which the current is generated by the magnetic action of another circuit. This term is usually applied to the circuit in a transformer in which the current has been generated by the action of the circuit connected to a source of energy.

Switchboard. A term used in referring to apparatus usually employed for controlling and measuring electrical energy at a given point.

Voltage. A term used to denote electric pressure. Electric pressure applied to a completed circuit will cause a current of electricity to flow just as water pressure will cause a stream of water to flow.

ORDERS FOR SAFETY IN ELECTRICITY.

Order 600. Dangerous Circuits. All circuits where exposed to contact and where the voltage exceeds 300 volts, are considered dangerous and must be guarded as such.

Order 601. Danger Signs. On all electrical apparatus located inside of buildings and carrying a voltage in excess of 300 volts, signs giving warning of danger must be placed.

Note. The most effective sign which has been adopted consists of a skull and cross bones with the word "Electreka" printed in white or aluminum letters on a red background. Practically all nationalities understand this sign.

Order 602. Grounding Electrical Apparatus. All motors, generators, transformers and starting or auxiliary equipment connected therewith and rated at 300 volts or over must have frames or cases permanently and effectively grounded. Where impractical to ground such apparatus the same must be effectually guarded. If metal guards are used they must be permanently grounded.

Note. It is recommended that the frames of all motors and generators be permanently and effectively grounded.

Order 603. Switches and Switchboards. All switchboards must be constructed of incombustible, non-absorbent material and must be supported

upon a metal frame rigidly and substantially braced and effectively grounded. Where not so placed as to be isolated, as in a separate room or upon a gallery, switchboards must be guarded at the rear with a metal screen which must be grounded, provided with a door hung upon self-closing hinges and equipped with automatic catch capable of being operated from either side of the door. No shelves, cabinets or other means for storing material will be allowed behind the switchboard and the space behind the switchboard must be kept clear at all times. Single-throw switches must be so mounted as to tend to open by gravity.

Order 604. Clearance Back of Switchboards. All new installations of switchboards, rated 300 volts or less and having a width in excess of 3 feet, must be provided with a space of not less than 2 feet actual clearance between the equipment mounted upon the back of the switchboard and the wall or other structure which determines this dimension. Switchboards rated more than 300 volts must be erected so as to provide a clearance of not less than 3 feet in a similar manner.

Order 605. Switchboards Equipped with Mats. The front of all switchboards rated at 300 volts or over, with exposed live parts on the face of the board, unless constructed on floors of insulating material, must be equipped with rubber mats or hardwood racks.

Order 606. Protection for Switchboards. All switchboards rated from 300 to 6,000 volts must be provided with the following safety equipment: (a) Insulating stools equipped with insulators rated at not less than 4,000 volts. (b) Two pairs of rubber gloves tested to 6,600 volts alternating current. (c) Proper insulating tongs for handling potential-transformer fuses. (d) Six rubber blankets not less than 20 inches square and one-eighth inch thick. (e) If ladder is required the same must be of special construction and of a non-collapsible pattern.

Order 607. Safeguarding Remotely Controlled Electrical Apparatus Driving Machines. All devices which control electrical machinery or apparatus must be so located that a man can see the working parts of the machine controlled by the device. Where this is not possible, a disconnecting switch must be placed at the machine or a remote-control apparatus must be provided with safety switches placed at all necessary points around the machine.

Order 608. Exposed Live Parts Guarded. All apparatus rated at 300 volts or over must have all live parts exposed to contact insulated or guarded to prevent accidental contact.

Order 609. Man in Charge of Generators. A competent man must be kept on duty where generators rated in excess of 300 volts are operating, unless the generators are located in a locked room, or are otherwise adequately guarded.

Order 610. Neutral of Three-wire Systems Grounded. The neutral of all three-wire distributing systems, where the voltage does not exceed 150 volts to ground, must be permanently and effectively grounded.

Order 611. Panel Boards Enclosed. All new installations of panel boards, motor controlling switchboards and similar electrical apparatus, where the voltage between parts on the front of the panel exceeds 300 volts, unless otherwise isolated, must be entirely enclosed in a cabinet made of non-combustible material or such apparatus must be adequately guarded.

Note. It is recommended, where possible, that the bottom of such cabinets be made to slope outward at an angle of not less than 30 degrees, so that the cabinet cannot be used as a storage place. Ample space should be allowed between the live parts and the case.

Order 612. Switch-Handle Insulation. All manually operated switches must be provided with handles insulated to withstand at least three times the rated voltage. Operating handles may be made detachable if desired.

Order 613. Arc Lamps—Construction. New installations of lamps of the arc type must be constructed as nearly as practicable of non-combustible material, and must be kept supplied with globes. No exposed portion of the lamp, with the exception of the terminals, must form any part of the circuit of the lamp.

Order 614. Safety Appliances. Every employer operating overhead or underground lines must provide for the use of employees required to work upon such lines, a sufficient number of the following safety appliances:

(a) Rubber gloves of quality and texture to withstand a test pressure of 6,600 volts alternating current, applied for a period of not less than five minutes.

(b) Rubber blankets of good grade of sheet rubber, which must measure not less than 20 inches square and one-eighth inch thick.

(c) Rubber boots, which must be constructed without nails or other metal in any part.

(d) Insulating stools equipped with standard line insulators rated at not less than 4,000 volts.

(e) Employers must post in conspicuous places, where workmen congregate, notices advising the employees that the foregoing safety appliances have been provided by the employer for the use of the workmen and directing the workmen to make use of such appliances when working upon lines or apparatus operating, or exposed to other lines operating, at a voltage of more than 200. Such notices must also advise employees to exchange promptly any such safety appliances which appear defective. All employers operating overhead electric distributing systems shall require all employees who have occasion to work upon poles, to be provided with tool belts and safety straps. No employee shall be permitted upon poles unless so equipped.

Order 615. Conduits and Metal Moldings Grounded. On old and new installations of circuits carrying over 300 volts, rigid or flexible metal conduits, metal moldings, and metallic sheathing of wires and cables, must be permanently and effectively grounded.

Order 616. Live Wire in Manholes. No insulated wire or connections will be permitted in manholes or tunnels regardless of the voltage of the circuit of which the wire forms a part, except ground-return wires. Lighting sockets must be of the weatherproof type.

Order 617. Lightning Arresters. All overhead circuits must be provided with lightning arresters. Lightning arresters must be so arranged as to be easy of access for inspection or repair; must be connected to the line wires in a manner so as to avoid as far as practicable turns or angles in the connection between the line wire and the lightning arrester, and must be connected to suitable ground pipe or other satisfactory ground connection by means of a copper wire not less than No. 6 B. & S. gauge, which wire must be enclosed in a wooden molding from the point of connection at the ground to a point not less than 12 feet above the ground.

Order 618. Arc-Lamp Supports. All arc lamps must be suspended by an insulating hanger, the insulation resistance of which must withstand a voltage twice that of the circuit upon which the arc lamp is operated. Arc lamps suspended over streets or driveways must not be placed at a height less than 15 feet above such streets or driveways. Arc lamps suspended over sidewalks or passageways must not be suspended at a height less than 8 feet above such sidewalks or passageways. New installations of arc lamps operating upon series arc-lighting circuits will not be permitted inside of buildings except in electric generating stations.

Order 619. Spacing of Poles. New installations of wooden poles in cities and villages must be spaced at distances not greater than 150 feet. Poles must be not less than 5.5 inches in diameter at top, and must be reasonably straight, free from large knots, wind-shakes and rot.

Order 620. Crossarms. Crossarms must be of well seasoned straight-grained timber, free from large knots, wind-shakes and rot and must be attached to the pole by means of a bolt not less than five-eighths inch in diameter by passing entirely through both crossarm and pole. Each crossarm must be equipped with at least one metal brace with not less than 1.5 inches by one-fourth inch cross section, and same must be attached to crossarm in a substantial manner either by clamp or carriage bolt, and to the pole by means of a lag screw not less than one-half inch by four inches. Sidearms must be suitably braced with heel braces constructed of angle iron, wrought-iron pipe, or round wrought iron and same must be attached to crossarm by means of carriage bolts or clamps and to pole by means of two lag screws not less than one-half inch by four inches. At terminals, corners, curves and points of excessive strain, double crossarms or their equivalent must be employed.

Order 621. Spacing of Crossarms. In all new installations, crossarms must be spaced not closer than 18 inches center to center and must be so arranged that all lines must be maintained with a safe clearing both from the pole and from other lines.

Order 622. Poles to be Stepped. All poles carrying branch cutouts, incandescent lamps or other devices requiring frequent attention, must be provided with steps beginning at a point not more than 12 feet and not less than 10 feet above the ground.

Order 623. Guying. All pole lines must be equipped with guys so arranged as to take the strain caused by line wires at terminals, corners and curves. Pole lines must be head guyed at least four times per mile. Guy wires must consist of galvanized-steel strand and where carried across roadways or footpaths must be maintained at a height of not less than 18 feet

above the crown of roadways, and not less than 12 feet above footpaths. Guys running to anchors buried in the ground must be equipped with guards to make them readily visible. Each guy wire must be equipped with at least one strain insulator of a type which will not allow the guy to part in case of breakage of the insulator and which will withstand a test voltage of 5,000 volts when wet. Strain insulators in guy wires must be not closer than 8 feet from the ground.

Order 624. Line Wires. Line wires must be carried upon insulators of a design to provide proper insulation for the rated voltage of the wire supported upon the insulator. The factor of safety in such insulators must in no case be less than 2.

Order 625. Clearance of Lines. Line wires must be erected at a height not less than 20 feet above streets and public driveways and not less than 15 feet above walks and private grounds. Line wires carried upon viaducts, bridges and similar structures must be placed entirely beyond the reach of persons having occasion to use the bridges or viaducts as passageways, and as far as possible beyond the reach of workmen generally employed in the operation or maintenance of such structures. Where line wires must be placed in such a position that workmen may come in contact with the same, they must be protected, insofar as may be practicable, and warning signs must be erected and maintained by the owners of such wires, such signs in all cases to state the voltage of the wires.

Order 626. Insulation of Overhead Wires. All overhead wires within cities and villages operating at less than 5,000 volts (except trolley, telephone, telegraph or guy wires) must be equipped with triple-braid weatherproof insulation. Wires must be so strung as to be not closer than 10.5 inches and must be kept clear of all other objects, such as poles, trees, buildings and other lines. Overhead wires leading to a building must be so arranged as to avoid as far as practicable the possibility of contact on the part of the occupants of the building or with any awnings, shutters, signs, etc. Wires crossing roofs must be arranged to provide a clearance of not less than 8 feet above the highest point of flat roofs, and not less than one foot above the ridge pole or highest point of pitched roofs. Supporting structures for wires mounted on roofs must be substantially constructed and securely attached to buildings. Wires leading down the sides of buildings must not be brought closer than 12 feet from the ground and must in all cases be so arranged as to prevent accidental contact on the part of the occupants of the building. Insulation is not required on line wires of any voltage outside of the corporate limits of cities and villages.

Order 627. Electric Light or Power-Line Crossings. Where electric light or power lines cross over telephone, telegraph or other low-voltage lines in cities or villages, the distance between the supports of the electric light or power lines at the point of crossing must not exceed 150 feet, unless such power lines constitute a part of a power-transmission system in which the supports, insulators and line wires have all been designed for longer spans with proper factor of safety.

Order 628. Trolley Wires—Insulation From Ground. All trolley-wire supports must have a double insulation from the ground. In wooden-pole construction the pole will be considered as one insulation. The strain insulator must withstand a test voltage of not less than twice the rated voltage of the trolleys supported.

Order 629. Wires Crossed by Other Conductors. At all points where trolley wires are crossed by other conductors efficient means must be employed to prevent contact between trolley wire and other conductors through trolley pole.

RULES FOR STATION AND SUBSTATION ENGINEERS, WIREMEN, OPERATORS, HELPERS AND OILERS.

Suggested by S. B. Way, The Milwaukee Electric Railway & Light Company.

1. Read these rules each day when you come on watch until you have committed them to memory. After having been in the service of the company for a reasonable time, you will be examined as to your knowledge of the rules and failure to pass such an examination satisfactorily will be cause for discharge from the service.

2. Oilers and helpers must not enter high-tension compartments or enclosures unless accompanied by foreman, wireman or operators and by his direct order, or to afford relief to an injured person.

3. Oilers and helpers must not clean live machinery, switchboards, transformers, regulators, wires or cables operating at a voltage of more than 300 volts.

4. Apparatus and equipment of any kind operating at a voltage of 6,000 or over shall not be cleaned or repaired when alive.

5. When performing any kind of work on live wires, cables, transformers, motors, generators, busbars, switches, lightning arresters or other apparatus operating at voltages over 300 and under 6,000, rubber gloves and insulated stools must be used. Refuse to work without them. Use one hand only and keep the other in your pocket where possible.

6. In handling live electrical apparatus or working around moving machinery of any kind, think before you move and be certain you are safe and that you know what you are doing before beginning your work.

7. When high-voltage switches, compartments, buses, wires or cables have been disconnected for cleaning, see that they are short-circuited and grounded before proceeding with work. Make ground connection first when applying ground wire. Remove ground connection last, when removing grounding wires. Be sure switches, etc., are "dead" before applying ground connection.

8. Never open a disconnecting switch in series with an oil switch until you have made sure that the oil switch is open.

9. Never open or close a switch of any kind until you are sure it is the right one. Think twice before you act.

10. In placing generators or motors back in service after work has been done in connection with them, make sure that electrical connections are properly made. If you are not certain, take no chances but call your foreman or superintendent for instructions.

11. In replacing potential-transformer fuses, have the generator, line or cable, to which the potential transformer is connected, disconnected and made "dead" before proceeding, if possible. In every case use wooden tongs and rubber gloves and stand upon insulated stool.

12. In working around control or instrument wiring, be careful never to open the secondary circuit of a current transformer. It is dangerous.

13. Never lean against any electrical apparatus or supporting structure or enclosure. Be wide awake and on your feet squarely when around electrical equipment or machinery of any kind.

14. Be careful of your tools. Use no defective tools or equipment. Never lay your tools down on busbars, switchboard frames, scaffolds or ladders or around electrical machinery. Place tools in pocket, belt or tool bag when not in use.

15. In working on ladders or scaffolds, be sure they are safe and sound. Take time to prepare a proper and safe place to work.

16. If you notice any condition which you think unsafe, correct it at once if possible. If you cannot correct it, report at once to your foreman or superintendent.

17. Avoid all loose and temporary wiring. Never carry extension cords around switchboards or in switchboard enclosures. If light is needed, use permanently installed lights or use lanterns.

18. These rules are issued to be obeyed. No one has authority to amend or alter them. You will be held strictly accountable for your complete knowledge of them and the care with which you observe them.

RULES FOR EMPLOYEES OF CONCERNS OPERATING OVERHEAD DISTRIBUTING SYSTEMS.

1. Before ascending a pole be sure you have your safety belt and rubber gloves.

2. Be careful that all your tools are securely fastened in your belt when working on pole or ladder and in handling tools or other equipment have a proper regard for persons walking or driving below.

3. When you have reached the point on the pole where you are to work make use of safety belt and other safety appliances which you have been directed to use.

4. In working upon overhead wires be careful to stand so that if you should slip or receive an electric shock you will fall in your belt rather than upon the wires. All overhead wires must at all times be treated as though they were alive or grounded. This means that you must not touch two wires at the same time.

5. When working upon overhead wires always arrange, if possible, to stand upon the pole and work from below rather than above the wires. Before standing upon or using a crossarm for support for hand or belt make sure that crossarm is sound and securely fastened to pole.

6. Examine all tools, safety appliances, ropes and blocks, both your own and those furnished by your employer, before starting your work. Do not use any tools, safety appliances or other equipment which you do not think is in good order. Your own safety as well as that of your fellow

workman and of the public may be jeopardized by using faulty tools or other equipment.

7. Always report at once to your foreman or superintendent any defective material or work or other dangerous condition which you may notice.

RULES FOR ELECTRICAL DEPARTMENT EMPLOYEES IN PLANTS.

Suggested by Walter Nield, Illinois Steel Company.

1. All employees should at all times be careful in their work to guard against accidents, such as shocks, short-circuits and grounds.

2. Do not get careless or take any uncalled-for chances. See that the lines or apparatus on which you are to work are "dead" if possible (not electrified).

3. Be sure to use your danger signs on switches or apparatus on which you are to work and see that the sign is firmly affixed on the switch controlling this apparatus so that it will not be displaced by the wind.

4. It is a good idea to notify all parties present or near the place where you are working so that your presence is known, which will oftentimes prevent somebody from throwing in a switch or starting a piece of apparatus on which you are working, if perchance the danger sign becomes displaced.

5. Always remove the fuses from the blocks and put same in your pocket when working on a circuit.

6. Think twice before doing any work with electrical apparatus. In starting, testing or handling motors be sure to look about first and see that everybody is through with his work and away from danger before you close the switch which controls.

7. Don't go up among circuits or wiring of which you are not sure as to the voltage or kind of power they are carrying. Go to your foreman if you are in doubt.

8. Never fuss, fool or tamper with electrical apparatus or wires, as it is extremely dangerous.

9. Always see that conditions where you are to work are perfectly safe, not only to yourself but to those that are working with you.

10. Never trust to the insulation of wires. If you are called upon to work among them, see that additional protection is used, such as "Linemen's Protectors," etc.

11. When necessary to make hot taps or joints, always see that you are well insulated from the earth or any metal structure, also make only one tap at a time and insulate this carefully before making the remainder. Never expose or bare more than one wire at a time so as to avoid short-circuits. Overhaste is dangerous.

12. Remember that all new construction must be installed carefully and conform to the company's rules and must be safe to persons working around and in the neighborhood of same. Take pride in doing your work well and always with the idea that it must pass inspection.

13. When working around high-voltage wiring, etc., avoid the use of both hands as much as possible, as it is extremely dangerous and ofttimes a short-circuit is established from this cause. Keep one hand behind you or in your pocket.

14. When working upon electrical apparatus never hand anything to another person or lay anything down, as death may result.

15. See that all material left over from installing new work is cleaned up and brought back to the shop.

16. When a circuit is to be pulled at the main power station or otherwise, send a man in person to the operator and when work is completed the same person should report as before (phone conversation likewise). This avoids possible confusion and accident.

17. When putting in or working on incandescent lamps at any time, especially at night, do not expose your eyes any more than necessary as lamps are sometimes defective, mistakes are made and a bad flash results.

18. Never look at an arc or intense light for any period of time, as your eyes will become overstrained and sore as a result. Always go to the doctor and get some drops put in your eyes if exposed to a flash, though you do not at once feel the effects of the flash and think that your eyes have not been harmed, as artificial light will bring out the bad results and a painful and sleepless night will be experienced.

19. If you see any person tampering with electrical apparatus who has no right to do so, stop him at once and report him to his foreman.

20. If you see any operator of any piece of electrical apparatus who shows by his operation that he is ignorant of the correct way to operate such piece of apparatus, instruct him in its use and otherwise help to keep things running smoothly. If you see any electrical conditions that are unsafe or need repairing, or lighting conditions that need correction, correct them yourself if you are able, otherwise report them to the chief electrician.

21. In extinguishing motor fires, water should not be used except in extreme cases, but the fire should be put out with powder extinguishers, opening the motor to the atmosphere as little as possible. Always pull the main switch controlling any piece of electrical apparatus before attempting to put out the fire.

22. After 4 p. m. of each and every day, men at large and those working on high-tension circuits, such as alternating-current arc circuits, etc., must be on their guard and careful of said circuits as the engineer or attendant is instructed to connect up the high-tension panel ready to plug up all circuits on which there is no one working. If at any time men are sent to do any work on any of the above-mentioned circuits, they must report to the engineer or station attendant *first* and *in person* before going out on the circuit; and when work is completed, they must again report to the engineer or station attendant *in person* that they are off the circuit and that everything is safe and ready for the circuit to be put on. If any man or men who are sent out to do any work on any of the above-mentioned circuits do not know about or are in doubt in regard to any part of it, they must immediately report same to assistant electrician or foreman in charge, who will give them the information required.

23. When working on a 6,600-volt circuit, always short-circuit the three-phase wires with a chain or cable, after having pulled the disconnecting switch, and ground the end of same, to protect from static induced voltage from other lines.

24. When through with a piece of work, be sure that you replace all safety appliances and if you cannot do this, report to assistant electrician, who will arrange to have the work done.

25. Above all be on your guard for personal safety and that of your fellow workmen. Do your work with this aim in view as well as take pride in a good-looking and substantial job. Make yourself familiar with all of these rules and the general "Book of Rules."

ELECTRIC SHOCK AND RESUSCITATION.

Electric Shock Defined.

A man's body is an electric conductor, although a rather poor one, and current will flow through the body if it is part of an electric circuit. The amount of current that will flow through a man's body depends upon the voltage of the circuit, and the completeness of the contact between the man's body and the circuit.

Where a man takes hold of a circuit, carrying 5 or 6 volts, the current that will flow through his body is too small to be felt. A 110-volt circuit will cause more current to flow through the body, and a slight shock will be felt. A 220-volt circuit will cause a still greater current to flow, and severe but not dangerous shock will be felt. When the voltage is 440 or higher, a very severe shock is felt, and death often follows directly.

The best way to avoid electric shock is to keep away from live parts of the machine or device. Great care should always be taken when working around electrical machinery or apparatus. Wherever possible the machine should be disconnected from the line before touching any uninsulated parts. Insulated tools should not be trusted to give entire protection. Rubber gloves in good condition without metallic fastenings, will protect fairly well. Defective gloves should never be worn; they are dangerous. Where it is necessary to touch live parts of the machine, use but one hand, and protect the body by standing on an insulating platform, such as a dry board free from nails. Care should also be taken to place the body so that the involuntary recoil from a possible shock will remove the hands from the apparatus, instead of causing them to grasp it, and will not cause you to lose your balance and fall.

The code is concluded with the now standardized rules for resuscitation from electric shock drafted by a joint committee representing the American Medical Association, the National Electric Light Association and the American Institute of Electrical Engineers. These rules were published in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, of October 26, 1912, pages 802 to 804.

The wiring contract for the pumping station of the new Lima, O., State Hospital for Criminal Insane has been let to the McKeever Electric Company, 99 North Third street, Columbus, O. Over $50,000 of electrical work has gone into this institution, which will be completed this year.

THE EDUCATION OF THE PUBLIC IN THE USE OF STANDARD ELECTRIC WIRING MATERIALS.[1]

By J. E. Latta.

It has not been long since it was rather generally true that the man who had his house wired for electricity felt that in doing this he was preparing to undertake something in the nature of an experiment. Apparatus for the generation and distribution of electric current had not been developed to such a degree as to make it always certain that electric service would not be subjected to frequent and annoying interruptions; the prevailing rates for power were high; electric appliances, other than motors and lamps, were comparatively few; and the efficiency of even the best type of incandescent lamp was so low as to give it a rather poor showing when the cost of lighting was compared with other illuminants. Hence, it was not unnatural that the person adopting electric service should feel that he might soon have to discontinue it, and that he should object to spending much money on his wiring. Without doubt this, in a measure, accounts for the crudeness of many of the older installations of electrical work.

But the time when the desirability of electric service was an experiment is now passed. The property owner knows these days that the wiring in his building will be needed as long as will the walls themselves. Why, then, should the installation of flimsy, unstable wiring continue to be so common? Why is it that it is still easy to find a market for sub-standard wiring materials? The question is one that some of us have heard discussed frequently and sometimes at great length. It has been asserted that the cheap contractor is largely to blame. That he is wholly blameless none of us would undertake to deny.

Some of our friends would have us believe that the zeal of the central-station manager for connecting up new business likewise contributes to the disorder. While such a contention is not wholly without foundation, my own feeling is that this matter is made more of than the facts justify. For example, I know personally of towns where the lighting company, without any local ordinance to demand it, refuses to connect to any building in which the wiring has not been inspected and found to comply with the specifications of the National Electrical Code.

After all, is it not true that the real cause of the trouble is the ignorance of the public as to what constitutes standard electrical work, and that the real remedy is to be sought in the education of the public in this matter? In purchasing other things than electrical supplies the average citizen seldom makes low price the principal consideration; quality, not price, is the first thing taken into account, as a rule. Is it at all reasonable to insist that this would not be the usual procedure in the purchase of electrical materials, if the purchaser really knew the meaning of quality in goods of this class?

It has to be admitted, however, that it is much easier to convince ourselves of the necessity of a more general education of the public in the use of standard wiring materials than it is to work out definite plans for accomplishing such education. It is a question, in fact, as to whether the desired degree of education is possible at all or not. The time will probably never come when even the most intelligent layman will be able to distinguish between the better and the less desirable grades of electrical goods in a satisfactory way. He will probably always have to depend largely upon some other authority than his own judgment. The greater his confidence in a properly constituted authority the better. One who has made any considerable study of existing conditions cannot but feel, therefore, that the thing most needed is a more wholesome and more general appreciation of the National Electrical Code.

Although, like all other terrestrial things, the Code falls short of perfection, it is probably not too much to say that lack of confidence in it can arise from no other cause than ignorance as to how its rules are made and revised. The committee in charge of revising the Code has on it representatives of practically every branch of the electrical industry making any serious claims to engineering skill. Suggestions as to changes in the rules may be submitted by anybody who cares to submit them. Suggested changes are passed upon by the committee, and its recommendations are reported to an open meeting. It is here that the final adoption or rejection of any proposed amendment occurs, and any man who so desires may attend this meeting, join in the discussion and vote. It seems to me that there could be no more satisfactory way of making a set of rules. The Code is, to my mind, the most democratic of documents.

This recital about the National Electrical Code is gone into here not because it is new to all of you gentlemen, but rather for the reason that I have so often encountered the opinion, even among well informed electrical people, that the Code was the findings of some autocratic body with power to impose its wishes upon a helpless public.

The foregoing is a story that the public ought to know better. Why not have your advertising and your salesmen help to make the nature of the Code more popularly known, and thus make the road rougher for the pirate dealer in electrical supplies—the dealer whose principal claim to consideration is the fact that he can undersell his competitors—the fellow who is always ready to push the sale of sub-standard materials?

When I have called upon municipal officials with a view to convincing them that it is a mistake for any town to permit the use of old-Code wire, I have had no trouble in showing them the difference between the old wire and the new, but the bare statement that the Code specifies 1911 wire for concealed work has by no means always been convincing; there has been a demand for information as to what this source of authority, the so-called Code, was.

I know of a town where sub-standard wiring and the use of nondescript, hazardous fittings was for years the rule. Finally there went into this place an electrical contractor who put on a campaign of advertising. In the daily newspapers he told the public, in boldfaced type, what standard wiring means. He is now getting a large share of the wiring business in that town, and the first thing that his principal competitor does now when a prospective customer enters his place of business is to assure him that he sells only approved materials. That contractor is an educator; every salesman of electrical materials ought to be one. Ability to take orders for cheap goods is not salesmanship. When the lamp manufacturers wanted to educate the public to the use of tungsten lamps, three or four years ago, they proceeded by training their salesmen to the task. Having had charge of the training crew of one of the largest companies I know the methods that were employed.

I believe another thing that is very desirable is that the public know more about the work of the Underwriters' Laboratories along electrical lines, and that for such information it must in a measure depend upon the men who are selling electrical supplies. I have met salesmen on the road who were very properly making the fact that their goods were on the approved list a strong argument for consideration with any prospective customer,

[1] A paper read at the meeting of the Electrical Supply Jobbers' Association, Washington, D. C., February 17-19.

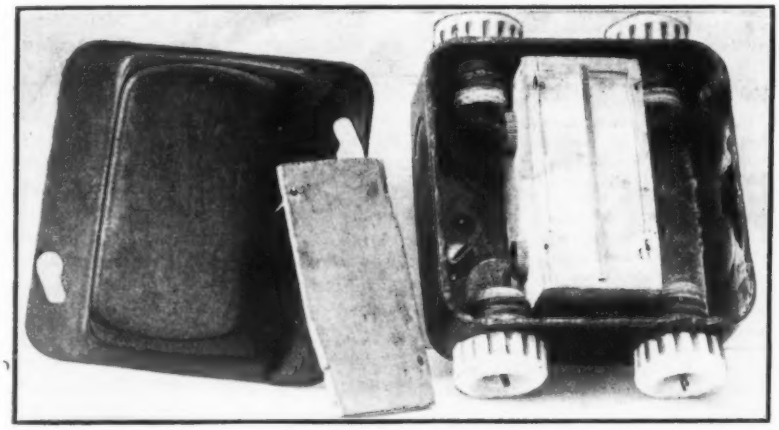
who had very incomplete notions as to what approval really means. For example, I have found salesmen who thought that when any given product of any particular manufacturer had been admitted to the Laboratories' label service, the manufacturer was entitled to apply labels to any unit in this class of products which he might offer for sale. As a matter of fact, however, the label service amounts to continuous supervision of the manufacturers' goods at the factory, and, as far as is practicable, this supervision is reinforced by following up the behavior of the labeled appliance or material in the field.

For example, in the case of rubber-covered wire the Laboratories' inspector at the factory tests enough of the factory output to convince him that the coils to which labels are to be applied are standard, and then there is what we consider a very complete field follow-up system. From time to time our representatives in the various parts of the country purchase coils of wire from the stocks of local dealers and send them to the Laboratories for examination and test. Moreover, there has lately been adopted the practice of sending out to every electrical inspector who will use them, cardboard tags for mailing samples of wire of doubtful quality to the Laboratories. The inspector who finds wire that seems to him to be sub-standard material uses this tag to forward a two-foot sample of it to the Laboratories, and gets a prompt report of the result of the Laboratories' test on the samples submitted without any charge whatsoever. Inspectors have manifested a disposition to co-operate heartily in this sort of follow-up scheme and the tests on the samples of wire submitted for examination have led us to believe that the use of sub-standard wire is not nearly so extensive as one would expect it to be, when there is taken into consideration the ignorance of the public in some quarters as to quality of wire and the always seductive prospect of saving a dollar on a wiring installation.

You gentlemen are doubtless familiar with our demerit system as it is employed in the label service on rubber-coverer wire. This scheme has been extended to rigid conduit and has been found to work well there.

The Underwriters' Laboratories are desirous of having the public know intimately of their work. We are in the field for service and not for profit. Our natural field, so far as the electrical industry is concerned, is the examination of materials to see that they conform to the requirements of the Code, but we miss no opportunity to do what we can toward educating inspection departments and the public to require standard materials. This, by the way, is a large part of my own personal work.

Even in the day when the cruder types of wiring prevailed the hazard of electric service was not great. That it was not was due mainly to the activities of a small group of pioneers in the field of inspection. With them began the campaign of education. Let us have unified effort to continue this campaign until even in the hamlet that is smallest and most remote from the vigilance of the electrical inspector there shall be no thought of using wiring materials that are not up to the standards prescribed by the National Electrical Code.



Device Sold as a Current Saver.

Unique Current Saver (?).

Of the numerous and well known devices designed to effect economy in the use of electrical energy, whether the economy is real or fancied, the simple and harmless-appearing fitting illustrated herewith must be given a place by itself.

Appearing in use in Chicago in the outlying residential districts during the past summer, its meteoric career ended suddenly, owing incidentally to the fact that meters are read from time to time and inspectors are still in existence.

It will be seen that the appliance consists of a standard stamped-steel outlet box and cover, and that porcelain bushings are provided for the wire leads, which form a part of the equipment. The removal of the cover discloses a small wooden box imbedded in a hard cement which entirely fills the rest of the space in the outlet box and seals the lead wires from view.

Extending across the wooden box is a partition of thick glass forming two compartments, which in turn are filled with a white material, such as plaster of Paris.

This combination was sold at a reduced price of only eight or ten dollars, a real bargain at that, for the installation was made without extra expense. No tools were required, for the operation consisted simply of twisting the ends of the lead wires around the service wires, meter loops, or any convenient place on the circuit, using a little tape to hold the thing in place, after which it was guaranteed to prevent the meter from racing or running too fast, to average the loads so that no maximum peaks would appear, and even to protect the premises from danger or injury during thunder storms.

If any doubt was expressed as to the economy and great utility of the device the installation was made "on trial" and a deposit accepted "on account" for a month's service.

But alas, after using electric lights, flatirons and cookers extravagantly for several weeks and finding the current bills larger than ever, the assistance of the meter man and inspectors was invoked, only to find that the wires that are carefully bushed through the top of the box extend *unbroken* and *well insulated* through the opposite bushings at the bottom of the box! Moral—"Do it electrically!"

Among the Contractors.

The City of Riverside, Cal., is building a new City Building. The order for the supply and installation of the indirect lighting fixtures in this structure has been given to D. Coldren, of Riverside. Mr. Coldren has also recently completed the installation of lighting fixtures in the Riverside Public Library.

The Southwest Electrical Company, of Redlands, Cal., has recently completed the installation of the ornamental street lighting system in that town.

The Harry I. Wood Company, Louisville, Ky., is to install the wiring for 28 three-phase, 440-volt motors for the H. Pilcher's Sons organ factory in Louisville, Ky. This will be a complete conduit installation.

National Association of Electrical Inspectors.

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"LET THE CODE DECIDE."

Secretary's Message.

There are one or two questions which make a more or less frequent appearance in the Secretary's mail and it seems as if it might be worth while to call atention to them here. The first that occurs to me is this: "Would it be permissible to return mains back through a service pipe, the feeds are carried in a conduit on the outside of the building to cutout and switch in the basement and returned through the same conduit thence through a second entrance under the eaves to the distribution center." This question or what is practically the same problem was considered at length in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, of July 5, 1913, page 21, and I would refer those interested to that place. That there are those who still meet with it is evident, because the question has appeared in my mail four times in the eight months which have elapsed since it was answered.

In that same issue (Question 231) appeared a related problem, that of the tap circuit run in the same conduit with the main. In order to meet the question raised here it is noted that the new edition of the Rules of the City of Boston contains a modification of the last sentence of Rule 26*p* of the Code, inserting the qualification that the four two-wire or three three-wire circuits allowed must be of not over 660 watts each.

Another question is this: "In frame houses do you consider it a good installation to have the service pipe placed back of the lath and plaster running down to the basement where the main switch is placed, pipe ends and meter is installed?" This question was answered in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, of March 1, 1913, on page 451. There were eight replies, and each stated the practice would not be permitted; however, the Secretary's files show seven inquiries during the year that has elapsed.

My third example is this: "Is there anything in the Code to prevent the using of a double pole snap or flush switch to control two different 660 watt circuits of lights, one leg of each circuit being carried through one leg of the switch?"

The matter appearing in this section consists of questions on the National Electrical Code, its interpretation and meaning, and questions as to whether certain methods of wiring are in accord therewith. These questions are gladly received from anyone interested, even if not a member; they should be sent to the secretary with any needed elucidating sketch. They are answered by each member of the Executive Committee according to his knowledge of what the ruling would be in his jurisdiction.

It should be understood that no pretense is made to give an authoritative interpretation of the Code. This is a voluntary association; it has representation on the Electrical Committee of the National Fire Protection Association, which prepares the Code, but it has no right, and claims no right, to give a final interpretation of anything in the Code. It is only intended to give the interpretation which seems correct to the members of the Executive Committee. No attempt is made to edit or correlate the answers from the different members of the Committee, as it is felt that the occasional difference of opinion is calculated to lead to a further study of the matter in question, further discussion and the final clearing up of obscure points.

The aim is to help toward a better understanding of the Code on the part of all; a more uniform conception of its meaning; increased precision in applying it; and harmonious action of those using it, for the common good.

This question was answered on page 472 of *Electrocraft* for July, 1911. We find there 12 replies; of these, 7 considered it to be permissible, 3 stated that it would not be permitted in their jurisdictions as they did not believe it in accordance with the Code, while the remaining two felt that it was not touched upon by the Code but that they should try to discourage the scheme, it being just as easy and practically no more expensive to put two single pole switches under one plate.

Some of the suggestions made were: That it would make a difference whether the two legs of the switch were—

(a) In the two outside wires in case the two circuits were taken from opposite sides of a three-wire main,

(b) Both in the neutral in the above case,

(c) Both in the same wire in case the circuits tapped a two-wire main,

(d) In the wires of opposite polarity in this case.

Again it was suggested that in case the switch were used this way there would be two ruptures of independent circuits, whereas used normally the two breaks were in series and might be considered to divide the potential drop.

A third suggestion was the possibility of crossing the wires in the switch so that if there were two single branch cutouts side by side the left cutout might run through the right side of the switch and vice versa.

In the two years and a half which have passed this question has re-appeared over a dozen times.

Another question which turns up less frequently but still fairly often deals with a three-wire circuit with plug fuses and a small 220-volt motor tapped off same, what type of fuses must be used in the various places, it being understood that they were inside the 30-ampere bounds.

In regard to this the Secretary suggests that our members re-read the clauses covering fuses under Rule 68*f* and believes they will be considerably interested, and possibly somewhat surprised.

The Secretary is now in a position to help members who would like to become enlightened as to practice in different localities regarding specific points, by transmitting inquiries to the secretaries of the several sections when they may be discussed at the section meetings and the resulting ideas sent to the questioner.

There are many points wherein interchange of opinions and mutual discussion are very enlightening and helpful to us all, and the Secretary earnestly wishes that the members make more use of his office. Several times he has appealed to the members to send him any interesting matter, anecdotes, etc., which continually occur, not to

speak of the serious matters of our work, but the response is as the Irishman said "a stunning silence."

Please take note of this and give the Secretary just a bit of a lift for he very much desires to be able to supply this column with matter of interest twice a month, and it is really a hard job, whereas just a little help from the members would ease it up a whole lot.

Regarding the two questions herein contained there is little or nothing to be added. As to the spacing of 500-volt switches in cabinets, it may be worth while to note that the street-railway condition referred to in answer 5 is complicated by the possibility of the high-potential discharge of a field magnet when the switch is opened. This also applies to all cases where the switch controls a motor circuit, of course, things should be so arranged that when the switch is opened the field can discharge through the armature or other circuit but once in a while conditions are temporarily such that it does not. The inductive field discharge can be a horribly spiteful affair and under such conditions the very widest spacing is none too much. In the case of a non-inductive circuit on the other hand, there is nothing particularly disturbing about the 500 more than the 250 except that it hurts considerably more, and may be seriously dangerous to persons of abnormal heart conditions.

Switch Spacing in Cabinets.

Question 255. In installing a 500-volt knife switch in a metal cabinet is any greater spacing required between cabinet and live parts than in the case of a 250-volt switch?

Answer 1 (W). No.

Answer 2 (D). Rules are inadequate. At least two inches should be required.

Answer 3 (U). The only rule that would apply is that giving the distance between switch parts of opposite polarity for the voltage stated, by analogy to this case.

Answer 4 (V). All switch boxes we have met with have liberal allowance, but if distance from nearest metal live part and box differed from Rule 65, Table 4 would require a change to conform thereto.

Answer 5 (O). Rule 75*a* does not require any greater spacing for 500 than for 250 volts. It would, however, be very poor practice to install 500-volt apparatus without inserting barriers between current-carrying parts and the grounded metal of the box. In case of grounded street-railway circuits, personal experience has shown that this is needed for satisfactory work.

Answer 6 (Y). No.

Answer 7 (R). Not according to Rule 65, Table 4.

Answer 8 (B). The Code does not differentiate as to distance required between walls, back or door of cabinet and any exposed live metal parts of devices contained in same when such devices come under the classification "Low-Potential Systems, 550 *volts or less.*"

Answer 9 (N). There is no distinction in the Code.

Answer 10 (E). We generally expect to see 4 inches being influenced in this position by Table 5, Rule 65.

Answer 11 (Q). No greater spacing required for 500 than for 250 volts.

Answer 12 (H). Rule 65, table 4 should give a pointer. Spacing should be same as for between live metal parts.

Answer 13 (S). No. Rule 70*a*.

Answer 14 (X). Yes, compare Tables 3, 4, 5 in Rule 65.

Answer 15 (P). I should be obliged to decide, in accordance with Rule 65*c*, that the requirement of 0.5-inch space between the head of the supporting screw and the nearest live metal part furnishes a precedent for requiring 0.5-inch space between the metal of the box and the nearest live metal part irrespective of whether the switch were designed for 250 volts or for 500. Rule 65*c* is a general requirement for all voltages of switches.

Show-Window Fixtures.

Question 256. Rule 30c limits the use of fixtures when wired on the outside. Does this restriction apply to fixtures of the chain type?

Answer 1 (W). Certainly.

Answer 2 (D). This type of installation should be governed by Rule 32*e*, I think.

Answer 3 (U). I should say that chain fixtures do come under this rule.

Answer 4 (V). This rule does apply to chain fixtures but in windows where they are hung high and the nature of the business is such as to assure that no goods will be suspended thereto nor pins nor decorations come in contact with them I allow them to be used.

Answer 5 (O). Rule 30*c* is intended to apply to all fixtures wired on outside, in the case of chain fixtures, however, the wire is usually stranded (77d) and by referring to Rule 32*e* it will be noted that inspection departments may authorize by special written permission, the installation of chain fixtures in show windows. It is not expected that inspection departments will exercise this right in cases of show windows liable to contain quantities of readily inflammable material.

Answer 6 (Y). Yes.

Answer 7 (R). Yes. The rule is intended to prevent inflammable material in show windows from coming in contact with the wires.

Answer 8 (B). The restrictions of Rule 30*c* apply to chain fixtures as well as to any other type. Exceptions may, however, be made in chain fixtures as permitted by Rule 32*e* relating to flexible cord.

Answer 9 (N). When the chain fixtures are properly wired I usually apply the option of Rule 32*c*.

Answer 10 (E). I do not so hold when the chain fixture is properly wired and with approved wire.

Answer 11 (Q). Yes; unless special permission be obtained.

Answer 12 (H). I should say it certainly does.

Answer 13 (S). Yes.

Answer 14 (X). Yes.

Answer 15 (P). I am of the opinion that the general prohibition contained in Rule 30*c* against the use of any exposed wiring in show windows is modified by Rule 32*e*, which states specifically that chain fixtures (which, of course, carry exposed wiring) may be used in show windows under special permission.

San Francisco Office for Commerce Bureau.

In the issue of February 21 we announced the establishment of branch offices of the United States Bureau of Foreign and Domestic Commerce at New York City, Chicago and New Orleans.

An additional branch office has just been opened at San Francisco, Cal., its address being Rooms 76 to 78, Appraiser's Stores Building.

Public Service Commissions

GEORGIA.

Macon Railway & Light Company. The Commission has rendered a decision in the Macon electric-rates case in which the Macon Railway & Light Company asked for authority to increase rates. Under the company's former rates commercial lighting and power current was furnished at from 4.05 cents net down to 2.02 cents net per kilowatt-hour and residence lighting current for from 6.75 cents down to 5.85 cents net per kilowatt-hour. The company adopted these low rates anticipating severe competition of the Georgia Public Service Corporation. The rates ordered by the Commission are, for residence lighting, a maximum rate of 9 cents net per kilowatt-hour for the first 50 kilowatt-hours' use per month, and for commercial lighting and power, a maximum rate of 5 cents for the first 100 kilowatt-hours' use per month.

The Commission criticises the action of the city in granting a franchise admitting the competitive company instead of applying to the Commission for reasonable rates and improvement in service of the company first in the fields. Real competition is now gone, and the companies are controlled by the same interests. The result is unnecessary duplication of property upon which the public must pay a reasonable return.

The decision states that "the Commission earnestly believes that it would be wise if the Legislature would prohibit the building of duplicate public utilities, or the grant of franchises to such, prior to application to and issuance by this Commission of certificates of public convenience and necessity."

IDAHO.

Competition Prevented. Upon the petition of the Great Shoshone & Twin Falls, Water Power Company operating in the city of Twin Falls, the Commission ordered the Idaho Power and Light Company to immediately desist and refrain from constructing an electrical transmission system in the city of Twin Falls or furnishing electrical energy within the city. The Commission held that the service of the Great Shoshone and Twin Falls Company is adequate and that public convenience and necessity does not require the service of the Idaho Power Company. The latter company had commenced construction work in Twin Falls but had not applied to the Commission for a certificate of public convenience and necessity. The company contends that it had the right to do this without securing a certificate from the Commission as it is a part of the company's general transmission system which had been under construction prior to the enactment of the Public Utilities Law under the permit issued by the state engineer permitting the use of water power from the Malade River. The Commission points out, however, that the franchise to do business in Twin Falls was not accepted by the company and that construction work was not begun until after the Public Utilities Law was in effect and that the right of the company to enter Twin Falls was, therefore, clearly dependent upon the Commission's approval.

A similar holding was made in the case of the Southern Idaho Water Power Company against the Beaver River Power Company, and the defendant was ordered to desist and refrain from further construction of an electric transmission system within the city of Pocatello. The petitioner is furnishing service in Pocatello and the commission held that public interests would not be conserved by the entrance of a competing company.

The Washington Water Power Company was authorized to put in effect flat rates for electric lighting in the Couer d' Alene mining district of Northern Idaho.

The Northern Idaho & Montana Power Company, of Sandpoint, was authorized to put in effect a combination heating and power rate for laundries of 2.5 cents per kilowatt-hour subject to a 10 per cent discount if paid on or before the tenth day of the month succeeding that during which current was used, with a monthly minimum of $2.00 per kilowatt connected.

The Kootenai Power Company was ordered to put in effect in the City of Couer d' Alene reduced rates as agreed upon between the municipality and the company.

The Idaho-Oregon Light & Power Company was authorized to put in effect a new schedule providing a material reduction in the company's rates.

Uniform Rates. The Commission of this State has issued an order requiring the Great Shoshone and Twin Falls Water Power Company and the Idaho Power and Light Company, formerly the Beaver River Power Company, to furnish electricity at uniform rates in the towns of Wendell, Gooding, Mountain Home and Glenns Ferry. The ruling was made on the complaint of the town of Wendell in which the charge was made that the former company had discriminated against that town in the matter of rates as compared with the rates charged in the towns of Gooding, Glenns Ferry and Mountain Home.

ILLINOIS.

Acting Secretary Resigned. William Kilpatrick, who has been acting secretary for the Public Service Commission, has resigned.

Franchise Approved. . The Commission approved the franchise granted by the village of Noble authorizing Henry W. Schilling to conduct a telephone business in the village.

Certificate of Public Necessity Denied to Competing Telephone Company. The Commission has denied a certificate of convenience and necessity to the Bethany Mutual Telephone Company to operate in Macon County. The Macon County Telephone Company is furnishing service in this territory and the Commission held that public interests would be best conserved by regulation of the rates and service of the company furnishing the service rather than by authorizing a competing company to offer duplicate service.

MASSACHUSETTS.

New England Telephone & Telegraph Company. The United Improvement Association of Boston asked that the Commission order the New England Company to restore four and six-party telephone service for suburban residences. The Commission finds that six-party line service is "unsuited to a multi-exchange district like the metropolitan suburban where the service problems at best are most complex," and holds that it would be contrary to the public interest to take any action which would result in increasing this type of service. The Commission recommends that the company restore to

its schedule for further trial the four-party line suburban residence service. If it becomes apparent that this class of service is unduly burdensome to the general service, the matter of its retention may be reconsidered.

MISSOURI.

Telephone Engineer. George P. Player, telephone engineer for the Oklahoma Corporation Commission since its organization, has taken a similar position with the Missouri Commission.

NEW JERSEY.

Eastern Pennsylvania Power Company. The Board of Public Utility Commissioners has partially dismissed complaints against the Eastern Pennsylvania Power Company of New Jersey and the Easton Gas Works regarding the exaction of advance deposits for meters. The Board finds that the $5 deposit now asked is not unreasonable except as to prepayment meters, in which case it announces that an abatement of this amount to $2.00 must be made, and requests the Easton Gas Works to notify it within two weeks of the modification of its rule reducing the sum to such an amount.

The State Supreme Court has handed down a decision affirming that the Board of Public Utility Commissioners has a right to refuse to approve franchises granted by municipalities where it is deemed that the utility is not necessary for public convenience, and denies the mandamus writ applied for by the Eastern Telephone & Telegraph Company. In its opinion the Court states that the power of the utility board is not limited by statute to supervising the execution of the permission and consent granted by a municipality, but includes the power to determine whether the privilege or franchise conserves the public interest. The Eastern company was recently granted franchises by the Board of Freeholders of Cape May County and by the Borough of Avalon for telephone and telegraph lines, same being refused by the Board of Public Utility Commissioners on the ground that such territory is now properly served.

NEW YORK.

Importing Power From Canada. The Public Service Commission, Second District, has granted permission for the further importation of electrical power from Canada.

The Commission granted the application of the Canadian-American Power Corporation, a new domestic concern, to engage in business, to issue stock, and to merge with itself the Niagara Falls Electrical Transmission Company. The Canadian-American Corporation seeks to take over a contract with the Electrical Development Company for furnishing 46,000 electrical horsepower produced in Canada, the current to be sold in the United States.

Permission was desired to issue $3,000,000 stock on account of the contract, and $435,000 for the purchase of the Niagara Falls Electrical Transmission Company. The Commission restricted the issue of stock to a total of $1,250,000. Of that amount $435,000 may be 7-per-cent cumulative preferred stock. The permission is granted upon certain conditions, including these: (1) That every contract with purchasers of electric current shall contain a clause that the price and the terms and conditions affecting the price and the duration of the contract shall be subject to revision by the Commission upon complaint or upon the motion of the Commission, if it shall appear to the Commission that the said price, terms, or conditions are unreasonable or unjust or operate to produce unjust discrimination or undue or unreasonable preference or prejudice, advantage or disadvantage as between customers. (2) That the company will so arrange its charges for electric current that they shall not on the average exceed $19 per horsepower, but that this shall not operate to prevent the Commission from requiring a lower price to be accepted for different kinds of service from that which this applicant may establish and have in force. (3) That until the further order of the Commission it will reserve at least 23,000 electric horsepower from its sale capacity for sale to consumers of electric current for light or power.

Discrimination in prices charged by Canadian electrical producing companies, whereby Canadian purchasers are favored to the prejudice of American customers and the existing shortage of electrical power on the Niagara frontier, are discussed in the opinion, with the finding that the various contracts with the producing companies should be revised as to prices charged the American distributing companies, and that there is a large shortage of electrical power in Western New York, with a strong demand for a greater supply which is not being met by existing companies, and also that the contracts mentioned tend to perpetuate high rates to consumers.

The Commission points out that the Hydro-Electric Commission of Canada has contracted for current delivered at a Canadian producing plant for $9 per horsepower in large quantity, while the charge for Canadian electric current to this company for a large amount of power is $12.50 per horsepower. It is stated that for a considerable period such discrimination has been practiced in favor of Canada and against distributing companies in New York.

OHIO.

The Dayton Light & Power Company is authorized to issue six-per-cent cumulative preferred capital stock of the par value of $297,800. The stock is to be sold for the best price obtainable but for not less than 80 per cent of the par value. The proceeds of the stock is to be used to reduce outstanding common capital stock in the amount of $250,000, and to reimburse the company for certain additions and betterments to petitioner's plant. The company's petition for authority to issue stock to obtain money to cover the partial cost of the reconstruction and rehabilitation of the company's property and for extraordinary expenditures, beyond the normal, made necessary to operate its property during and subsequent to the flood of March, 1913, is continued for further investigation.

Union City Electric Companies. The Union City Light Company of Indiana and the Union City Ohio Electric Company applied to the Commission for approval of a contract for the furnishing of electric energy. The Commission held that its approval is not required under the law, but if a contract is entered into a copy is to be filed with the Commission.

The Commission approved the transfer of the property of the Union City Light Company, located in and about the village of Union City, O., to the Union City Ohio Electric Company for $1,500, the sum agreed upon by the companies. The purchasing company was further authorized to issue $1,500 of capital stock to be sold at par value for the payment of the purchase price of the property to be transferred.

OKLAHOMA.

The Pioneer Telephone and Telegraph Company. The Oklahoma Supreme Court has refused a rehearing to the telephone company on its appeal from the order of the Corporation Commission requiring it to refund approximately $62,000 in alleged excess charges to subscribers in Oklahoma City. The court recently affirmed the order of the Commission and upheld the constitutionality of the law passed by the fourth Oklahoma Legislature, authorizing the Commission to take charge of the collection of such refunds from public service corporations and distribute them to the individuals directly affected. That order is now made final, unless appeal is taken to the Supreme Court of the United States.

WISCONSIN.

Annual Report of Utilities. The compilation of the detailed reports of the income account and balance sheet of the public utilities of the state for the year ending June 30, 1913, is practically completed.

The Method of Flicker for Color Photometry.

At the meeting of the Philadelphia Section of the Illuminating Engineering Society on January 6 a paper by C. E. Ferree and G. Rand entitled "A Preliminary Study of the Deficiencies of the Method of Flicker for the Photometry of Lights of Different Color," was presented by Professor Ferree. This paper presented the preliminary work of a study of the method of flicker, which is still in progress.

A satisfactory method of photometry should enable small differences in luminosity to be detected and the results should be reproduceable for a given observer with small variations, and for a number of observers with slightly greater variations. The method should also possess logical sureness of principle, or its results must in the average agree with those of some method which possesses this sureness of principle. Great difficulty has been experienced in obtaining methods of photometry for colored light which have these features. The present methods are of two kinds; one involving direct comparison or equality of brightness, and the other involving the method of flicker.

With regard to sensitivity, the equality-of-brightness method has the following disadvantages: (1) small differences in luminosity cannot be detected because the actual difference is masked by difference in color quality; (2) results for a given observer cannot be reproduced within small enough limits; (3) results cannot be reproduced by different observers because the sensitivity to color varies more than the sensitivity to brightness and because the standard for judgment of equality differs more in different individuals when the factor of color is present.

The method of flicker possesses greater sensitivity than the equality-of-brightness method, because color differences are eliminated when the eye is exposed successively to colored and colorless light. Both impressions are distinct at low rate of speed. At a higher rate there is color flicker, then color fusion, then brightness flicker, and finally complete color and brightness fusion. In color photometry the speed must be such as to obtain color fusion without brightness fusion. Under this condition a very slight change in one of the impressions will produce flicker when there is no flicker. Flicker thus becomes a very sensitive means of detecting difference in brightness. This sensitivity however, is not so great for colored as for colorless light.

The method of flicker, however, does not possess the sureness of principle required of a satisfactory method. At the necessary rate of speed the eye is very much underexposed to the stimulus; and the observation of flicker is subject to variations dependent upon the following factors, the effects of which have not all been adequately studied and sometimes not even recognized: (1) the intensity of illumination and the rate of giving the impressions to the eye; (2) the different rates of speed required for the fusion of different colors; (3) the effect of the saturation of the colors used on the rate of fusion; (4) the effect of the size of field; (5) the effect of the ratio of the times of exposure of the lights to be compared. The authors are studying these factors and believe that greater knowledge of them is of fundamental importance in the method of flicker.

The eye does not respond at once with full intensity of sensation at the beginning of stimulation nor does the sensation cease with the cessation of stimulation. This time lag is different for different colors, and it is longer for any of them than for colorless light. With higher intensities the time is shortened. The time is shortest for green, slightly longer for blue, and still longer for red. Values were given for the times found by various observers, all of which were of an order of magnitude greater than the time of exposure in the method of flicker. The eye is consequently very much underexposed in this method and the intensity of sensation is therefore reduced. If all sensations were reduced in like proportion this would be no objection, but the reduction is different for different colors. There is apparently no point in the intensity scale for which the given reduction in intensity for colored light gives the same change in luminosity and sensation that it does for colorless light. Beginning with the spectrum of fully saturated colors and comparing the effect of reduction of colored and white light by equal amounts, the blues and greens are found to decrease in luminosity more slowly than white light and the reds and yellows decrease faster. There is a relative lightening of the blues and greens and a relative darkening of the reds and yellows. This is not confined to low intensities, although it is more striking for the lower intensities. The situation becomes still more complicated if the rate of flicker is changed, and yet it must be changed to preserve the sensitivity of the method in passing from high to low illuminations.

Results of experiments were given to show that in the method of flicker there is a characteristic underestimation of the brightness of red and yellow and overestimation of the brightness of blue and green. This deviation is due to the method of exposure used in the method of flicker. A variation of results was found depending upon the ratio of the time of exposure. The results do not in the average agree with results obtained by the method of equality of brightness.

A method was described which possesses a degree of sensitivity almost as high as the method of flicker and gives results more closely in agreement with those obtained by the method of equality of brightness. It is similar to the latter method, but does not require the observer to judge impressions differing in color quality. It depends upon the extreme sensitivity of the peripheral retina to brightness contrast. In this part of the retina very small changes of illumination are required to produce a noticeable change in the amount of contrast.

The apparatus needed for the method consists of a vertical screen 60 by 50 centimeters, with an opening at its center 15 millimeters in diameter; a motor to carry the measuring disks; and a photometer bar. The surface of the screen is covered with magnesium oxide. This screen is graduated in the horizontal meridian from the center of the 15-millimeter opening. Directly behind the opening is placed the gray which is to serve as the contrast stimulus. The measuring disks are made up of a sector of gray and a sector of black, the varying proportions of which produce the match which is needed between the stimulus of gray, darkened by contrast, and the measuring disk. The measuring disk is carried by a motor the shank of which extends through the screen. When in position, the inner edge of the disk extends approximately to the 20-degree point of the graduations. Immediately in front of the disk and 25 degrees from the center of the stimulus opening is placed the fixation point. The photometer bar is placed in a plane normal to the screen midway between the stimulus opening and the fixation point. The contrast stimulus and the measuring disk thus receive equal amounts of light from the source to be measured.

The method is applied as follows. The observer's eye is lined up with the stimulus-opening by means of a device attached to the screen which need not be described here. The standard lamp is placed on the photometer bar at a given distance from the screen, the eye is turned out to the fixation point and the sectors on the measuring disk situated just back of the fixation point are adjusted by means of a number of separate judg-

ments to match the gray at the stimulus-opening darkened by contrast. The value of these sectors becomes the index of the illumination of the screen for the standard lamp at the given distance. The standard lamp is then removed, and the comparison lamp is placed on the bar, and its position adjusted until the contrast stimulus again matches the measuring disk. Since the proportion of sectors has not been changed from that which was determined for the standard lamp, it can be assumed that the illumination of the contrast screen is again of the same value it was for the standard lamp at the given distance. The comparison of the two light sources, thus, can be gotten directly from the distance readings on the photometer bar. The advantage of the method for color photometry is that in the judgment both for the standard and comparison lights the surfaces, the brightness values of which are being compared, are both illuminated by the same light. The eye is thus never compelled to make its judgment of two surfaces differing in color quality.

Motor Economy and Standardization in Railway Shops.[1]

It is known that in every machine shop there are two distinct service conditions, calling for different types of motors, different methods of control and different methods of applying the motors to the machine tools. That is, there are certain types of tools requiring motors of the constant-speed type, and others whose cycle of duties demands an adjustable-speed type of motor (wrongly called variable-speed motors), those whose speed can be varied to suit conditions, but when fixed remains constant under varying loads.

Alternating-current motors are essentially constant-speed machines, and because of their comparative simplicity several plants have adopted them almost exclusively for their constant-speed work in woodworking shops, driving pumps and fans, line shafting for groups of small tools and for certain large tools requiring constant speed. On the other hand, no commercial method has as yet been devised for varying the speed of an alternating-current motor so it may be used successfully and satisfactorily for machine tool service.

On the other hand, where direct current is available, motors suitable for both constant speed and for adjustable speed are available by the use of direct or continuous-current motors. And since it is now possible to get motors with speed variations of as great as 30 to 1 these motors should not be overlooked.

While it is true that the lack of a proper understanding of the joint problems of the motor and tool builder has been a great drawback, thus showing the necessity for some standardization of speed-ratios, control and dimensions, there is also a lack of standardization of the method of supplying the power in machine shops. At present there are about fifteen possible systems available, all of which are in use in various shops and several of them at once in some shops. For instance; we have direct current at 110, 220 and 500 volts and alternating current at 110, 220, 440 and 550 volts and in single, two and three phases at frequencies of 25 or 60 cycles.

So long as this is the case it will be hard to do much in the way of standardization of shop equipments, and, therefore something should be done toward the adoption of certain standard power equipments for use in shops.

The present tendency among steam railroads is to install turbine-driven alternating-current generators in their power plants, using this current for lighting, turn-table drive, woodworking machines, etc., and installing motor-generator sets to supply direct current for cranes, variable-speed machine tools, etc. This is good practice, so far as it goes, but it frequently goes too far and we find that motors of nearly every possible kind are used in some shops, and that is demoralizing, to put it mildly. If we would profit by the experience of the central stations, whose conditions are similar to ours, a long step in the direction of standardization could be taken very quickly and easily.

When a machine shop is driven through a line-shaft it is not easy to determine the amount of time each machine is in operation, but when electric motors are used (especially as individual drives) it becomes easy to determine both the load-factor and the load, and thus the motor economy. And one of the first things noticed after the adoption of individual motor drives was the fact that the total horsepower capacity of the motors in a given shop was always in excess of the generator capacity. A small difference must be expected, but frequently the ratio is as great as 6 to 1, showing that the average time load-factor of the majority of machine tools is comparatively low.

Analyzing this from the standpoints of time of loading, cutting, unloading and idle time shows that it is very seldom necessary to use motors of very high continuous ratings. In fact, for use in railway shops, motors with an intermittent rating based on much less than two hours' continuous service have been found entirely satisfactory. This means that motors of much smaller size than formerly used are being installed, with a consequent reduction in costs of equipment. This also has a direct bearing on the cost of doing work, through fixed charges.

The most important point is the relative economy of the individual motor drive as compared with line-shaft drive, and this may be summarized as follows: less power required; more speeds possible; time saved in speed adjustments; time saved in reversing; time saved in setting up; time saved by getting proper speed for cutting; time saved by taking heavier cuts; less liability of accidents; more compact arrangement possible and increased economy of operation.

[1] From a report of the Shop Practice Committee of the Association of Railway Electrical Engineers.

Massachusetts Power for Rhode Island.

George I. Smith, president of the New England Power Company, Boston, states that under a contract recently entered into with the Narragansett Electric Light Company, Providence, R. I., power will be supplied to large consumers in the Rhode Island territory and also a large amount of energy will be furnished to the Narragansett Company's lighting plant, the steam plant to be held in reserve. The New England Power Company's hydroelectric plants are located on the Deerfield River, in northwestern Massachusetts, where four plants are in operation, with a fifth development soon to be effected. The total output will then approximate 55,000 horsepower. About a year ago the New England Power Company of Maine leased the plants of the Massachusetts Company, and also acquired control of the Connecticut River Power Company.

Rules for Linemen.

Representatives of nearly all the electric lighting and transmission companies of Connecticut met at Hartford on February 19, and voted to accept a set of standard precautions for linemen on transmission work which had been formulated by a committee of electrical men called together by the state Public Utilities Commission. These rules will be scrutinized by the Commission and an acceptance printed for distribution among the employees of the companies. The committee which drafted the rules was made up of representatives of the United Electric Light & Power Company, Waterbury; Hartford Electric Light Company, Hartford; United Illuminating Company, New Haven; Southern Telephone Company; Western Union Telegraph Company; Postal Telegraph & Cable Company; and Connecticut Power Company, New London.

American Institute of Electrical Engineers.

Midwinter Convention at New York City, February 25, 26 and 27.

The second midwinter convention of the American Institute of Electrical Engineers was held in the Engineering Societies Building, New York City, February 25 to 27, under the auspices of the Electric Power Committee. The total registration at the convention was 465, and there was an average attendance at the sessions of about 100.

In connection with the convention there was a publicity meeting on Wednesday evening, February 25, with regard to the International Electrical Congress to be held in San Francisco in 1915 in connection with the Panama-Pacific International Exposition. At this meeting addresses were made by C. P. Steinmetz, William Rader, W. D. Ryan, James A. Cruikshank and P. M. Lincoln. All except the first of these was illustrated with lantern slides, and Mr. Cruikshank's talk included some motion pictures. Dr. Steinmetz spoke with respect to the Electrical Congress; Mr. Ryan described the lighting of the exposition grounds; Dr. Rader described the exposition buildings and grounds; Mr. Cruikshank portrayed scenes on a trip to San Francisco; and Mr. Lincoln described and illustrated some of the electrical developments that may be seen on such a trip.

On Thursday evening the I. E. C. dinner-dance was held at the Hotel Biltmore. H. G. Stott acted as toastmaster and brief responses were made by A. E. Kennelly, chairman of the Committee on Program, and by E. B. Rosa, honorary secretary of the Congress. The affair was attended by nearly 350 and was a great success, due largely to the efforts of George F. Sever, chairman of the Committee on Arrangements.

The first session of the convention was called to order by President Mailloux at 10:30 a. m., on Wednesday, February 25. He referred to last year's convention and the precedent then established of having a midwinter convention under the auspices of one of the Institute committees. This had proved so successful that the midwinter convention will probably be an annual event. He explained the method followed in the appointment of committees during the current year and the importance of the subject delegated to the Electric Power Committee. He then introduced D. B. Rushmore, the chairman of that committee, who presided during the session.

Mr. Rushmore made an introductory address, in which he pointed out the analogy between the growth and development of the Institute and of civilization. He showed a number of lantern slides which included curves and statistics showing the production of electrical apparatus, engines, fuel, copper, aluminum, the cost of living and of electric light, the earnings of utilities and many views of electrical machines and applications of electric power.

P. H. Thomas, chairman of the Subcommittee on Engineering Data, then presented a report giving an outline of the Committee's ideas of what might be done in this field. He divided engineering data into three classes: (*a*) Information of an exact character, such as theoretical formulas, methods of tests, physical constants, systems of units, etc. (*b*) Information as to forms of construction or elements of design, such as is useful to an engineer doing specific work. This includes performance figures for power-plant apparatus, transmission lines, measuring instruments, etc. (*c*) Information of a more specific character applying only to special situations where the conditions are not easily set forth. Such information would be of little use in connection with any different problem. Only data in classes *a* and *b* should be considered, and the collection should be limited by excluding data already available in satisfactory form; data which has principally advertising value; and data about which there is not general agreement among engineers.

Harold Pender then presented the report of the Subcommittee on Handbook, dealing with the feasibility of publishing an Institute handbook. This committee had investigated what had been done by other societies and found that some to the advantage of their members issued a number of special publications dealing with particular narrow fields coming within their province. None of them had considered it advisable to issue a general handbook covering an entire branch of engineering. The members of the subcommittee felt that it was neither desirable nor practicable for the American Institute of Electrical Engineers to compile and issue a complete handbook of the subject.

The discussion was opened by H. F. Thomson, secretary of the Handbook Committee, who had communicated with 22 other societies, nine of which were foreign, and had found that the Society of Automobile Engineers was the only one of them to issue a handbook of engineering data. The publications of all the others were of a very special nature. He had some interesting comment on the subject from secretaries of the various societies.

H. M. Hobart presented printed discussion pointing out that the individual members of Institute committees could probably not produce anything better in the way of a handbook than had already been turned out by commercial publishers. He thought, however, that the influence of the Institute could be exerted in such a way as to secure better results with these commercial handbooks. He suggested cooperation in this matter with other engineering societies. He favored publication by the Institute of volumes on special topics which would include information not only from the Institute *Transactions*, but also from papers submitted before other engineering societies. Data can be divided into two large groups; a small group of up-to-date matter and a large group of out-of-date matter. He suggested that tables of data and Institute papers could be made complete in themselves and collected separately and published.

P. M. Lincoln pointed out that a similar publication by the corresponding German society which contains specifications for many kinds of electrical construction represented an evolution from a small beginning.

Comfort A. Adams pointed out the inefficiency of the present methods and results in compiling handbooks. Present handbooks are very inadequate, but he recognized the great difficulties in the way of the Institute producing a handbook which would be worth while. It would represent a stupendous amount of work and he suggested that it would be preferable for an Institute commitee to oversee the compilation of a handbook by a commerical publishing house.

E. J. Henkle pointed out the advantages which the Institute would have in collecting data and referred to the publication by a German mining society which was the best thing in its field and was being copied in other countries.

W. J. Hammer suggested that a looseleaf form of publication would be preferable, the Institute sending out individual sheets as fast as data were compiled and calling upon each member to supply any that he had compiled by himself.

Calvin W. Rice, secretary of the American Society of Mechanical Engineers, regarded such publication as entirely legitimate if the Institute de-

cided that it was desirable and feasible.

Selby Haar approved co-operation between the Institute and handbook publishers and referred to the "Nautical Almanac" as an example of what can be done.

In closing, Mr. Thomas expressed surprise that there were not more in favor of publishing a handbook, and Professor Pender emphasized the enormous amount of work necessary for good results. Poor methods are usually used in the commercial publications. The detail work should be paid for and done under the direction of a committee acting without pay.

President Mailloux thought that the Institute publication, if one were decided upon. should not be classed as a handbook and should not compete with, but supplement, the production of the commercial publications. It should contain a record of the progress in electrical engineering from year to year.

Power-Station Session.

At the afternoon session, also presided over by Chairman Rushmore, the first paper was by James Lyman, Allen S. Rossman and Leslie L. Perry, entitled "Protective Reactances in Large Power Stations." The paper was presented by Mr. Rossman.

Protective Reactances in Large Power Stations.

The concentration of a large generating capacity on the busbars of a single power station demands protection against an excessive flow of current into an accidental fault. Reactance coils can be used in various ways to limit the instantaneous current flow. Reactance coils in the generator leads, while limiting the flow of current from the different generators, are not efficient for limiting the current flow into a fault. Bus reactances are less bulky and less expensive than generator reactances; are more efficient in controlling the current flow, have the advantage of localizing the effect of a fault to one or more sections of the busbars. They have the disadvantage that, under normal conditions of operation, the current flow across them may cause an undesirable drop in voltage. The ideal system of bus reactances would afford maximum protection to service and equipment in emergencies but, under normal operating conditions, would give minimum voltage difference between various points in the busbars. The straight bus, the ring bus, and the ring-and-transfer bus approach this ideal condition in the order named. Reactance coils in each feeder circuit are extremely effective in limiting the flow of current into a short-circiut on the feeder and in isolating the effects of this short-circuit from the other parts of the system.

The discussion was opened by Philip Torchio, who pointed out that the authors had figured on ten per cent internal reactance in the generators, which as now built may correspond to that figure, but most of the machines already installed have less reactance than this, say five per cent at 25 cycles. This value will greaty modify the curves of the authors. Where feeders run in parallel to a substation they may form a shunt to the reactance between bus sections and thus diminish their effect. This fixes a useful limit to the value of such reactances. Reactances in the busbars should have the same current capacity as the switches. He would make this carrying capacity high and the percentage reactance lower.

W. S. Moody pointed out that since a reactance is inserted for protection it should not itself introduce any danger or weak points. On a constant-potential system an amount of reactance that interferes with the constancy of the voltage, that is, with regulation, is prohibitive; inside of this limit the more reactance the better.

H. G. Stott described the installation of the Interborough Rapid Transit Company. He had found the great need for reactances to be to protect the cables from the generators and gave some figures to show what enormous effects might result without such protection. This company has adopted an arrangement different from any of those mentioned in the paper. The external reactance is inserted between each generator and the busbar and the buses are sectionalized by switches. An additional smaller reactance connects each generator to an auxiliary bus. The maximum short-circuit current which is possible is about 20,000 amperes, instead of 60,000, which would be possible without the reactances. It would be preferable to have a reactance protect each feeder, but this was found impracticable on account of the space which would be necessary. The reactance coil itself should be rugged and indestructible by heat.

P. M. Lincoln pointed out that the transient current at the beginning of a short-circuit may be double the value of the permanent current. Generators cannot be injured by short-circuiting, and the problem is to protect the service.

V. Karapetoff advocated the use of reactances in the field circuit of the generators to limit the first rush of current upon short-circuit. He gave the result of some experiments to show the effectiveness of this method.

H. R. Woodrow stated that field coils were often punctured on account of the high voltage induced in them and it was not advisable to insert reactances in the exciter circuit as they would probably emphasize this danger. He also pointed out that the maximum value of the transient current cannot be more than 1.6 times its permanent value.

C. M. Davis preferred reactances in the generator and feeder circuits rather than between the bus sections.

In closing the discussion, Mr. Rossman stated that some work had been done upon reactances in the feeder circuits which would be described in a future paper. Although the reactances in these circuits were smaller than those required in the generator circuits there were so many more of them that this was no advantage.

Four papers dealing with substations were then presented and discussed together. They were as follows: "Outdoor versus Indoor Substations," by Alexander Macomber, presented by Frank C. Sargent; "Outdoor Substations in New England," by Fred L. Hunt; "Indoor and Outdoor Substations in Pennsylvania," by H. L. Fullerton; "Outdoor Substations in the Middle West," by Leslie L. Perry, presented by D. C. Jackson.

Outdoor Versus Indoor Substations.

The development of the outdoor substations versus the indoor type is an interesting commentary on the adaptability of engineering progress to new fields and the subject is briefly recappitulated in this paper, in line with the developments and application of this branch of transmission work. The causes for development of this apparatus, together with a general description of the classes of apparatus involved with have been changed to meet new conditions, are given. The application of the indoor versus the outdoor substations to services of different character is indicated, and the tendencies for the future briefly touched upon. A comparison of the advantages and disadvantages of the types considered is outlined. The advantages of an outdoor installation are its lower first cost, ease of extension, reduction of fire hazard, and simplicity of layout. Its disadvantages are the difficulty of making repairs, operating risks, danger to public, and appearance. For the small isolated substation up to a few hundred kilowatts the cost will be 25 per cent to 50 per cent less than the corresponding indoor station. In large installations the saving will therefore be much smaller. Up to the present time there are installed or under construction approximately 300,000 kilowatts in high-tension outdoor-type transformers. In general, it appears that the equipment for outdoor installations has been successfully developed to meet the severe conditions imposed, and the numerous installations involving outdoor features indicate the extensive use of this idea in the future, while its development as applied to the central station itself affords a considerable field for attention.

Outdoor Substations in New England.

The present development of outdoor switching apparatus and transformers for systems of 110,000 volts or less is such as to make their use entirely successful, and in most transformer substations, a considerable saving in first cost can be accomplished without increase in operating expenses, by making use of this type of equipment.

This paper gives a brief description of two substations of 10,000 kilowatts, ultimate capacity, just put into operation, in which all the high-tension switching apparatus (66,000 volts) and the transformers are outdoors. The low-tension apparatus (13,200 volts) and the railway apparatus are indoors. This arrangement is based on the three following principles which have in this case proved to be sound: (1) That the greatest saving in building cost can be made by putting all high-tension work outdoors. (2) That the switching apparatus, lightning arresters and transformers of voltages in the neighborhood of 66,000 volts are practical and may be successfully operated outdoors in New England. (3) That distributing switchboard, control switchboard and railway apparatus and switchboard are not suitable for outdoors.

Indoor and Outdoor Substations in Pennsylvania.

This paper covers some points in substation design for installations for the lower voltages, including choice of location, type of building and arrangement of electrical apparatus. The subject is treated in three divisions: customers' substations fed from the distribution system, customers' substations fed from the transmission system and company's substations. In selecting a location for transformers there should be considered: (1) the position of the customer's load; (2) location of company's street mains; (3) accessibility for delivering material; (4) accessibility for the operating company's employees, and (5) possibilities of ventilation and sewer connections. Among the advantages of outdoor substations which the author enumerated were reduced cost of installation, increased accessibility for employees, lessened difficulty in making connections to lines, absence of transformer vaults, and better ventilation. Indoor installations, on the other hand, offer the advantages of (1) having the apparatus more accessible for inspection or repairs, (2) involving less danger of unauthorized persons interfering with apparatus, (3) giving customers control of the installation on the primary side if desired, and (4) protection of apparatus from the weather. Points to be considered in the selection of locations for substations are outlined and several types of buildings, particularly the one of concrete slab construction, are described. Attention is also called to different arrangements of electrical equipments, which may be employed for installations of various sizes. Different schemes for installing high-tension switchboard apparatus are considered, attention being called to the open-wire and the cell-structure installations, with special reference to the concrete cell structure and the method employed in its construction.

Outdoor Substations in the Middle West.

Conditions in the Middle West, particularly in the agricultural districts, have often been such as to necessitate the construction of small 33,000-volt outdoor substations in order to make the supply current commercially practicable. These stations have been constructed with very simple switching and protective equipment and economy of design and protection to the main line have been the dominating feature of design. Mr. Perry described and illustrated a substation which can be built economically to accommodate three 50-kilowatt, 33,000/2,300-volt transformers and the distributing equipment. The station consists of a corrugated-iron or steel transformer compartment six feet square, on top of which are supported electrolytic lightning arresters and a steel angle-iron frame carrying the horn gaps and choke coils. The low-tension equipment should be placed inside the compartment. To allow isolation of the substation equipment from the transmission line when repairs or inspections are being made the author recommended mounting disconnecting switches on a pole near the substation with levers and gear connection which can be operated by any intelligent man. Operation of such stations has been successful and they are of great benefit to the communities served. Improvement in lighting and overload protection is looked for.

In opening the discussion D. C. Jackson pointed out the accord between the four authors as to the importance of the outdoor substation and its suitability for the service involved. Many small communities can be served by such equipment, which otherwise could not be served upon any commercial basis.

A. H. Kreusi said that outdoor installations should be limited to small stations. In large stations the saving is too small to warrant it, since continuity of service is less certain with the outdoor station. He inquired whether there was any object in erecting the transformers on towers for outdoor stations instead of placing them on the ground. He also read a written discussion by A. R. Smith, who pointed out that economy was the principal object of the outdoor station, but that enthusiasts were sometimes deceived into thinking such stations economical when they were not.

R. E. Argersinger pointed out that the saving should be large to make the outdor station worth considering.

H. B. Gear considered the question a matter of balance between the cost of building and the cost of apparatus. In industrial substations, however, the question was often one of space rather than cost. For a small station the building sometimes costs more than the equipment. There is little saving in the case of stations for low voltages and large amounts of power and these often involve some equipment that must be housed anyhow. For higher voltages, where big air spaces are needed, he favored the outdoor station, especially, for small amounts of power.

W. S. Moody stated that the figure given by one of the authors of 600,000 kilowatts is too small for the outstanding capacity of transformer equipment. Outdoor transformers up to 7,500 kilowatts and outdoor stations up to 50,000 kilowatts have been constructed. It is important to have water-tight cases for the transformers, and idle units should have arrangements for heating them above the outside temperature, with provisions for permitting gases and air to escape.

J. C. Smith stated that outdoor stations were little used in Montreal, since they necessitated the use of air-cooled transformers. The operation of oil switches under severe climatic conditions is also an important question.

P. W. Sothman said that similar conditions prevented the adoption of the outdoor substation in Ontario. There is a big field for such stations, but there are also many places for which they are not suited. It is often a mistake to save on cost and sacrifice service.

J. E. Kearns said that in stations up to 5,000 kilowatts there was a saving of 10 to 15 per cent in the outdoor staion. The difference would not be so great if sheet-metal buildings were used. For larger stations there is more in favor of the indoor type. The outdoor type is more suited to the South than to the North or the Rocky Mountain region, but for capacities up to 100 kilowattts it can probably be used anywhere.

H. E. Bussey stated that outdoor stations up to 30,000 kilowatts were in use in Georgia, but he did not consider the climate there good for them, since heavy rains and winds were common. No trouble has developed so far but it is likely to develop if the tanks are not tight.

A. M. Rossman, K. C. Randall and Farley Osgood also spoke.

A. H. Kreusi submitted by title a printed outline for discussion on electrical features of power-station design.

Transmission Session.

The first session on Thursday was called to order by Chairman Rushmore at 10:20 a. m., and the report of the Subcommittee on Transmission was presented by P. W. Sothman. This report was entitled "Problems of High-Tension Transmission Lines," and was accompanied by four appendices, as follows: "Deterioration of Porcelain Insulators in Service," by J. A. Brundige; "Radius of Influence of a Direct Lightning Stroke," by L. C. Nicholson; "Transmission-Line Problems in the West," by P. M. Downing, presented by Julian C. Smith; "Switching," by G. Faccioli.

Problems of High-Tension Transmission.

This report contains suggestions regarding the construction and location of high-tension transmission lines. There is need for an intelligent agreement upon protection methods at crossovers. The selection and design of towers is dis-

cussed, and recommendations are made regarding the nature, strength and protection of materials entering into tower construction, as well as allowances for movement of wires, sleet and wind. Aluminum and copper conductors are often not equally suitable. Overhead ground wires are considered beneficial as a protection against lightning. Reports indicate that although suspension insulators of the disk-type with metal caps and pins are satisfactory for a year or two, failures begin to occur after this period. Much of the trouble on telephone and telegraph lines is due to insufficient insulation. By employing special grounding coils, good insulation, and frequent transpositions of power lines satisfactory telephone service over paralleling lines has been found to be possible. Constant improvement has been made in station apparatus, especially in the strengthening and protection of apparatus.

Deterioration of Porcelain Insulators in Service.—Many of the failures of suspension type insulators are traceable to improper design or to an unsuitable porcelain body, and not to molecular deterioration of the porcelain. High dielectric strength and mechanical toughness are the principal requisites for high-voltage insulators. Mixtures having these properties are possible but often not used. The lack of allowances for the coefficients of temperature of the component parts of insulators is responsible for many failures. The high-range megger has proved extremely useful for locating faults undiscoverable by ordinary means of inspection.

Radius of Influence of a Direct Lightning Stroke.—Observation and inquiry lead to the conclusion that it is doubtful if any degree of insulation used at present will withstand the effects of a direct lightning stroke. Experience indicates that a direct stroke envelopes such a large region that ground wires cannot always intercept direct strokes. On medium-voltage lines induced effects of distant strokes may cause flash-over or puncture of insulators. Radial influence of direct strokes is rarely in excess of 2,000 feet.

Transmission Line Problems in the West.—On the Pacific Coast leakage due to the accumulation of dust and salt fog is a constant source of trouble. Cleaning of the insulator improves conditions but most satisfactory results are obtained by tying pins together electrically. In most cases voltage must be kept nearly constant over entire network. This is accomplished by using synchronous condensers at important distributing points.

Switching.—Switching oscillations do not constitute a great danger to the circuit unless switching operation is accomplished by arcs in which case destructive cumulative oscillations may cause damage. The discussion shows that low tension switching is preferable.

The final paper of this session was presented by H. W. Buck and was entitled "Practical Operation of Suspension Insulators."

Practical Operation of Suspension Insulators.

This paper describes some of the mechanical and electrical problems which have been experienced in high-voltage-transmission lines equipped with suspension insulators, and points out some of the principles involved and some practical methods of guarding against troubles. Figures are given showing the deflections which will take place for various sizes of aluminum and copper conductors at the insulators, under the pressure of maximum probable wind velocity. The use of ballast weights at the end of each insulator is recommended for lines employing aluminum wire or the smaller sizes of copper wire. Simplicity in the designs of suspension insulators has been found advantageous. The following additional recommendations are made: more liberal clearance between conductors and between conductors and supports, installation of ground wire high above conductors, design of jumpers and fittings at head-end connection so that they cannot become displaced, and the tightening of conductors throughout the line.

In discussing the Committee report, Mr. Buck stated that the sag tables prepared by engineers are disregarded in the field, the line foremen usually exercising their own judgment. The design of lines and the directions for their construction should be within the scope of comprehension of the construction foreman.

F. W. Peek, Jr., discussed the difficulties of measuring disturbances on lines.

C. E. Waddell favored obtaining easements rather than the right of way for a transmission line. In lines up to 60,000 volts he favored wooden poles with fittings ungrounded rather than steel towers. Line supports should be free to move longitudinally but not laterally. He did not favor Mr. Buck's proposition for ballasting, as he considered it preferable to change the span or other elements of design so as to make this unnecessary. A steel-cored aluminum conductor is to be preferred for many installations. In case of a short-circuit the aluminum will burn off, but the steel remains intact and holds up the cable. He favored the form of insulator described by Mr. Buck.

P. H. Thomas referred to the deterioration of porcelain, many instances of which had come to light recently. He attributed the results to defects in the process of manufacture rather than to electrical causes or any actual change in the porcelain *per se*. A method of test in needed which will disclose the insulators which will later fail. The two-piece insulator is less likely to have both parts defective and has this advantage. He has obtained one with a flash-over tension of 90,000 volts.

W. H. Peberdy presented a written discussion by William McClellan, in which it was stated that towers should be designed on the basis of the elastic limit of the steel, and a specimen then actually tested for failure. He pointed out the distinction between the "factor of safety "applying to unit stresses, and "margin of safety" applying to a complete tower. The latter is of more importance in design. He also discussed tower footings. These when made of concrete should have an earth connection. He favored two suspension insulators mounted at 45 degrees at points where it was necessary to prevent unequal sags.

V. Karapetoff objected to drawing conductors up too tight, as he knew several cases where trouble had resulted from this practice.

Paul M. Lincoln disagreed with Mr. Faccioli regarding switching on the high-tension side, as he did not know of any damage resulting from this practice. The surges due to switching are not as great as others, such as those produced by lightning, and the line should be built to withstand any that may occur. He agreed with Mr. Buck as to drawing lines up tight.

A. O. Austin gave a talk on insulators and their failure, illustrated with lantern slides. He pointed out that the early lines were installed under different conditions than those existing today. Many insulators which had failed showed evidence of crystallization in the cement, calcium sulphate having separated out in many cases. Incipient cracks, air bubbles in the glaze, etc., are often the forerunners of failure. Insulators should be tested at high frequency.

Farley Osgood pointed out the need of co-operation between operating engineers and manufacturers in testing insulators under practical line conditions. He did not see how switching on the high-tension side could be avoided in busy territory. Most line difficulties result from high-frequency surges.

J. A. Sandford, Jr., did not favor covering the materials of manufacture in specifications of insulators, pointing out that ball clays from many different sources were the same chemically but differed in plasticity. Insulators show no fatigue when the porcelain has been completely vitrified. The fatigue occurs only in imperfect porcelain. If complete strings instead of single units were replaced in cases of breakdown there would be less trouble experienced. He favored the establishment of some central testing bureau in order to get comparative results on insulators.

Julian C. Smith stated that suspension-type insulators were no worse than pin insulators in respect to deterioration. He thought the number of insulators in a string should not depend upon the operating voltage but rather upon the climatic conditions, since their limiting strength should meet abnormal conditions.

E. A. Lof pointed out that the height of lines did not depend upon voltage but was fixed so as to avoid all contacts with other structures. He called attention to a book on catenary construction recently published in Swedish by Carl Heuman.

E. M. Hewlett pointed out that a shorter petticoat means less strain and

readier flashover, which is the preferable condition. If the line is insulated to resist lightning discharges the apparatus must also be. It has yet to be shown that porcelain shows fatigue when well vitrified. The failures are probably due to defects which are at first protected by glaze. After the glaze cracks, moisture is absorbed and the unbaked porcelain breaks down.

Selby Haar pointed to the rapid increase in high-tension lines in other countries. Voltages up to 115,000 had now been reached in Japan, 110,000 in South America, and 100,000 in India and in Europe.

Power-Generation Session.

The afternoon session was devoted to power generation and economics and was called to order by President Mailloux at 2:30 p. m. H. W. Buck occupied the chair during the discussion of the papers. The first paper presented was by C. T. Hutchinson and was entitled "The Economical Capacity of a Combined Hydroelectric and Steam Power Plant."

Economical Capacity of a Combined Hydroelectric and Steam Plant.

This paper develops a general method for determining the economical capacity of a combined steam and hydroelectric development. The method involves the use of two curves—one, the "per-cent-deficiency," giving the stream regimen, the other, the "per-cent-load" giving the characteristics of the load. The first curve gives the per-cent deficiency of the water for any stream-flow, and hence fixes directly the deficiency in energy which must be made up by the steam plant. The second curve shows directly the proportion of the total energy of the load that is included above any proportional part of the maximum power, and fixes the capacity of the steam plant required to supply that part of the load which cannot be supplied by the stream. The use of these two curves differs for plants with pondage or without pondage. The capacity and output of the steam plant being thus determined, its total annual cost is determinable and with the annual cost of the hydroelectric plant, fixes the total annual cost of the combined plant. A numerical case is worked out applying to the Susquehanna River at McCall Ferry. The drainage area is about 26,000 square miles, and the results are reduced throughout to terms per square mile. Curves are given for stream flow, per-cent deficiency, loads and per-cent loads, and costs are worked out applying to various conditions. Reservoir capacities of different amounts are also considered. The application of the method depends upon the determination of the cost of a development at any given site for a range of capacities. The cost of any hydroelectric development is made up of certain items independent of the capacity of the equipment and others proportionate to the capacity. In most cases the fixed costs are much greater than the variable costs. Cost figures are given for a number of typical cases.

In discussing this paper H. B. Alverson spoke of the importance of the steam reserve in hydroelectric systems.

This was followed by a paper by H. M. Hobart entitled "The Cost of Electricity at the Source."

The Cost of Electricity at the Source.

The Stott-Gursuch method is applied to the determination of the cost of manufacturing electricity in a 60-cycle station of 100,000 kilowatts installed capacity, as follows. Costs are divided into three parts: (1) production costs; (2) investment costs; (3) administration costs. Production costs are divided into two parts, one of which is fuel; for the other portion $700,000 is allowed. The investment costs are based upon $35 per kilowatt of power plant. An efficiency of 13 to 15 per cent is assumed in the conversion of energy from fuel. Interest is estimated at five per cent, taxes and insurance at three per cent, amortization at 4.6 per cent. Administration costs are taken as $100,000. The results correspond to the assumption that such a station is capable of delivering from 350,000,000 to 700,000,000 kilowatt-hours per annum for load-factor ranging from 0.50 to 1.00. For unity load-factor the cost of three-phase electricity at the outgoing cables ranges from 0.65 cent per kilowatt-hour with coal at $5.00 per ton, down to 0.20 cent per kilowatt-hour for fuel of negligible cost. A method is indicated for tracing through the increase in the cost of the electricity at later stages of its journey from the source to the consumer.

This paper was discussed by John W. Lieb, Jr., H. S. Summerhayes, C. T. Hutchinson, H. W. Buck, F. A. Scheffler, H. L. Wallau, O. K. Howland, C. F. Scott, A. H. Kreusi and V. Karapetoff. It was pointed out that the conditions assumed by Mr. Hobart did not correspond with any existing in actual plants, especially under metropolitan conditions. Thirty-five dollars per kilowatt was entirely too low for first cost of installation. Thus one of the plants in New York City had cost $65 per kilowatt for land and buildings and $85 per kilowatt for equipment. A large plant now going up in the West for 125,000 kilowatts is expected to cost over $45 per kilowatt. This plant will have turbogenerators of 25,000 kilowatts each. The hydroelectric plant at Keokuk cost $180 per kilowatt and if the fixed charges were no higher than 12 per cent, this would make power cost more than it could be produced for from coal if Mr. Hobart's figures were applicable. Besides, a steam plant can usually be located near its load, whereas a hydroelectric plant usually requires a transmission line. Fixed charges should be figured at 15 to 20 per cent instead of the 12.6 per cent used by the author. Capital cannot generally be secured for five per cent and depreciation or amortization should be placed higher than 6.4 per cent. Much steam equipment becomes obsolete and useless within ten years and the New York Edison Company had made five changes in type of equipment since 1884. The load-factor assumed was also higher than is obtained in practice, where 30 to 45 per cent would be a fair figure. On these grounds it was objected that Mr. Hobart's paper would be misleading in that outsiders would take his figures as representing actual possibilities.

Professor Scott pointed out that a 15,000-kilowatt unit can now be installed in the space formerly occupied by a 150-kilowatt unit. Considering also the increase in lamp efficiency a capacity for about 300 to 1,000 times the same lighting can now be installed in the space formerly required. It should be remembered also that the cost of generation is a small item in the cost of supplying energy, the distribution cost being usually greater.

Professor Karapetoff commented upon the fact that 30 per cent of the cost was for accessories and thought engineers in this country should be interested in the Thury series system, which uses smaller cables and less auxiliaries for the same size of plant, thus reducing the capital cost.

In closing the discussion, Mr. Hobart admitted that the fixed charges should be figured at a higher percentage. He pointed out that his figures for installation cost were reasonable for a plant outside of the large cities, where land is very expensive. Thus a recent English station had contracted for 6,000-kilowatt units at $8.00 per kilowatt. His estimate was based on $8.50 for steam-raising equipment; $5.00 for condensing equipment; $10.50 for accessories; $8.00 for buildings and $3.00 for contingencies.

Distribution Session.

The session on Friday morning was occupied with a report of the Subcommittee on Distribution, of which Peter Junkersfeld is chairman. The meeting was called to order by President Mailloux at 10:30 a. m., and Chairman Rushmore occupied the chair. In the absence of Mr. Junkersfeld, H. B. Gear presented the report of the Committee. It was accompanied by nine appendices, as follows: "Three-Wire Direct-Current Distribution," by Philip Torchio; "Alternating-Current Distribution," by H. B. Gear; "Effect of Consumers' Apparatus and Wiring on Distribution," by Harold Goodwin, Jr.; "The Relations of Distribution Problems and Switching Equipment," by E. B. Merriam; "Distribution for Street-Lighting Service," by P. M. Lincoln; "Direct-Current Distribution for Surface Railways—Urban Service," by R. H. Rice, presented by Mr. Gear; "Direct-Current Distribution For Underground and Elevated Railways," by E. J. Blair, presented by Mr. Gear; "Direct-Current Distribution For Interurban and Steam Railroads," by W. G. Carlton; "Alternating-Current Dis-

tribution For Interurban and Steam Railroads," by W. S. Murray, presented by Mr. Gear.

Distribution of Electrical Energy.

This report discusses the economy of the centralization of electrical power generation and the centralization of distribution. Numerous references are given to articles on the distribution of electrical energy by American and foreign authors.

Three-Wire Direct-Current Distribution.—The modern three-wire direct-current distributing system consists essentially of a three-wire network of distributing mains fed at numerous points by a multiplicity of cable feeders, supplied with current from a system of substations. Marked improvements have been made in synchronous converters, such as the use of commutating poles, graphite brushes with slotted commutators and self-lubricating copper graphite brushes for the collector rings. Other developments have been the split-pole synchronous converter and the synchronous booster converter for obtaining regulation. Manufacturers have produced units as large as 4,000 kilowatts and are prepared to furnish larger units. From recent tests it would appear that diametrically connected six-phase converters will operate satisfactorily under the same conditions as a double-delta-connected machine, and give greater simplicity of connections between transformer and converter. Stand-by batteries giving large current discharges for short periods of time are being adopted for emergency purposes.

Alternating-Current Distribution.—Both bulk supply and general distribution are discussed. Bulk-supply systems in America have been chiefly developed on the principle of radial lines. Such a system employes direct lines from power station to substation. Tie lines between substations furnish a reserve source of power. Several methods of supplying substations are discussed on the basis of reserve investment. Until recently it has not been satisfactory to operate high-tension lines in parallel at the substation end on account of the absence of reliable reverse-power relays. The Merz-Price system of protective relays has had large and successful application in the north of England. The main disadvantage of this system is the expense of the necessary pilot wires. Modified forms of reverse-power relays have been developed within the past two years and are under trial. The introduction of synchronous converters and three-phase transformers of almost any desired capacity permit the use of cables at a point near their full safe carrying capacity. The induction-type regulator has largely superseded the transformer-type in substations. Extensive improvements have been made in the details of control and regulating apparatus. General distribution is usually accomplished in America by 2,200-volt mains, the customers being supplied from secondary mains at 110-220 volts. The advisability of furnishing light and power service from the same feeders is discussed. Modern pressure-regulating apparatus permits this combination in most cases. Three-wire and four-wire distributing systems are discussed. Emergency-switching points are necessary to permit mains of two circuits to be joined and to cut out sections of cable. A cross-connected network of secondary mains is preferable in denser parts of a city. The secondary system may be protected by "network protectors," such as are used in New York City. Motor service cannot usually be served from lighting secondaries. Selection of transformers and systematic checking of their loads is important where economy is desired.

Effect of Consumer's Apparatus and Wiring on Distribution.—It is advisable to have some fixed rule as to size of motor above which no single-phase service will be rendered and below which polyphase service will not be rendered. General practice requires auto starters on motors of any size. Automatic-self-contained starting devices for motors have been marketed. Rectifiers, cooking stoves, medical apparatus, etc., are usually allowed on lighting systems, except where their use makes trouble. Wireless apparatus is generally undesirable. Charges for electric service are not ideal. It would seem well to devise some system basing the minimum charge on the starting current instead of the horsepower rating.

Direct-Current Distribution for Surface Railways—Urban Service.—Various methods of distribution are discussed. Marked developments have been made in generating, converting and control equipment for power houses and substations.

Direct-Current Distribution for Underground and Elevated Railways.—Various methods of distribution are discussed. On account of numerous distribution points it does not seem desirable to increase voltage above 600 volts direct current.

Direct-Current Distribution for Interurban and Steam Railroads.—Extensive direct-current electrification of steam railroads has been made. It is not probable that 600 volts will be used extensively for this service. Numerous roads have adopted 1,200 volts. The Butte and Aanconda Railroad is operating successfully on 2,400 volts.

Alternating-Current Distribution for Interurban and Steam Railroads.—In general, the alternating-current contact wire is not adapted where the equipment must be common to city and interurban operation. High-voltage, alternating current at 25 cycles supplied by single overhead wire is well adapted to steam-railroad electrification.

The Relation of Distribution Problems and Switching Apparatus.—Means are being sought to give complete protection against service interruption due to faults in the distributing and receiving apparatus. Several schemes have been devised for indicating the unbalancing of phases. Numerous improved forms of overload relays and reverse-power relays have been devised. The carbon circuit-breaker is almost universally used for direct-current voltages up to and including 1,200 volts. Up to 5,000 volts direct-current magnetic-blowout circuit-breakers are successful. Oil-immersed circuit-breakers are generally used on alternating-current circuits. Owing to increased generating capacities now concentrated in single units, means are necessary to aid in the dissipation of energy. The most efficient solution of the problem is a scheme introducing resistance into the circuit in shunt with the oil circuit-breaker during its operation.

Distribution for Street Lighting Service.—A separate distributing circuit is best adapted for this service, because it must be switched on and off at certain periods. Where this system is not used lamps are operated in groups. The series system is best adapted. Constant current is secured from constant-current generators or transformers. The use of constant-current transformers in conjunction with rectifiers has largely taken the place of constant-current direct-current arc machines. The series system is well adapted to both arc and incandescent lamps. Series-incandescent lamps are shunted by special reactance coils which carry the full current upon the breaking of a lamp.

The discussion was opened by H. L. Wallau, who emphasized the keynote of the report, which is centralization, eliminating duplication of generating and distribution equipment. This usually means lower cost and increased reliability. This can only be carried out as far as the substation, since beyond that point different kinds of service are required. In Cleveland, cables are being connected in parallel with relays installed for protection. The substation buses are not segregated, but operate in multiple. Rotary condensers are used in the substations to improve the power-factor. The weatherproof insulation on 2,200-volt cables has been found to deteriorate with time, but it remains good enough for these lines to be connected in star.

In answer to a question, D. W. Roper stated that with the system used in Chicago for four-wire, three-phase lines, short-circuits on the neutral present no difficulties. The circuit-breaker opens on the wire which is short-circuited, and compensators maintain the proper pressure on the other two wires. It seldom happens that the neutral wire becomes open near the station. The relays on this system are set for very high currents, so as to avoid interruptions from overloads. The relays are intended to operate only on short-circuits and not on overloads.

In answer to another question, Philip Torchio stated that the size of the neutral wire in a three-wire system is a question of regulation. The New York Edison Company keeps the regulation very low by using a large neutral conductor and the system as a whole has been liberally designed. The neutral might well, however, be made smaller than the other wires.

E. M. Hewlett spoke of the applications of relays and of oil switches, which can now be supplied for almost any purpose for which they are desired.

J. B. Taylor stated that the controlling reason for the use of the series system in street lighting was the characteristic of the arc lamp. Another reason was the fact that direct current was universally used initially and a series circuit represented the use of the lowest amount of copper. With the high-efficiency tungsten lamp and the use of alternating-current circuits there is now little reason for using separate circuits for street lighting.

A. P. Kelly referred to the interruptions caused by circuit-breakers and the fact that induction motors will

drop out in such cases. In Baltimore, auxiliary relays have been installed which will automatically close a switch as soon as it has been opened, the time taken being about 0.7 second, or within 40 cycles on a 60-cycle circuit. This prevents interruption of service or even a heavy current flow to accelerate the motors. Switch relays may be set to close once, twice or three times before permanently staying open. Telephone disturbance had been caused in Baltimore from a thirteenth harmonic in the neutral circuit of frequency changers, which suggested the use of this current for testing faulty cables by the use of a detector coil and telephone. This characteristic, however, is being eliminated for operating purposes. His experience on four-wire systems was different from Mr. Roper's, as when one switch goes out all the rest open also. If the neutral wire is opened, the voltages on the different phases may change slightly but operation is not interrupted.

H. B. Gear explained in this connection that in Chicago the neutral wires are not grounded on each power load.

Carl Schwartz gave the details of the New York Central & Hudson River Railroad distribution system. He stated that the appendix by Mr. Murray did not represent present practice. Single-phase current costs more delivered than three-phase current. For insulated negative return feeders to prevent electrolysis, they must provide a uniform voltage over the system. It is often troublesome and expensive to meet this condition.

Others joining in the discussion were S. D. Sprong, H. S. Summerhayes, E. W. Trafford and W. A. Del Mar.

Protective-Apparatus Session.

President Mailloux occupied the chair at the final session, which was called to order at 2:30 p. m. The first paper was by C. P. Steinmetz and was entitled "Recording Devices."

Recording Devices.

The author calls attention to the importance of keeping records in electrical systems and points out that proper records can be secured only by automatic recording devices largely because of the uncertainty of the personal element in times of accident or stress. The three types of recording devices in general use are those having a revolving disk, those using an endless tape or photo-film, and a multi-recording device on which no record is made of normal operations and on which the record sheet moves only when a record of abnormal occurrences is being made. The revolving-disk machine produces such condensed records that a sequence of rapidly fluctuating events cannot be distinguished, while the curve-drawing instruments, if the tapes were run rapidly enough to show all the fluctuations, would produce records of such enormous length that they would be impracticable to operate commercially. With the multi-recorder the record is made in a very condensed and handy form and its accuracy in respect to time is very high, so that the sequence of events recorded can be checked within a fraction of a second. The latter instrument, therefore, is adapted to produce minute and accurate records of all phases of station operation.

E. E. F. Creighton described the apparatus referred to in the paper, known as the multirecorder. This gives a time record of the opening or closing of switches or any other change in circuit conditions. There are 49 points, each of which must have a pilot wire from the part of the system for which the record is to be kept.

Charles L. Clarke presented a printed discussion, in which he pointed out the great advantages of this recording instrument. Its action is so rapid that the sequence of operation of oil switches can be noted. Time-element relays can be checked to the nearest second. The duration of accidental short-circuits and surges can be recorded. It shows whether a feeder is alive, and if so, the time when it was energized and the end from which it was energized. It may show whether aluminum lightning arresters have been charged at correct intervals, and whether they have been abused by charging them too long. It is very useful to the load dispatcher. Lightning strokes on an overhead ground wire may be recorded. Applications outside of the power station were also noted, as for keeping records of a manufacturing plant.

C. P. Steinmetz pointed out that the apparatus was of great value in giving the sequence of happenings at widely different points, as for example on a long transmission system. One of the 50 points on the recorder can be used for standard time and then the instruments in different stations may have their records compared to show the sequence of events.

E. E. F. Creighton then presented a paper entitled "Present Status of Aluminum Lightning Arresters." He compared the aluminum arresters with other types of arresters and pointed out their various advantages. While the direct-current aluminum type of arrester may be improved, it is not likely to be superseded in principle. Recent investigations of lightning show that there are various kinds of wave fronts involved, not all discharges being of high frequency (500,000 cycles or over). The alternating-current aluminum arrester is not satisfactory unless horn gaps are used in series with it. A large rush of current through the arrester is sometimes found objectionable and this has led to the use of a resistance in series. Abroad some bad experiences have been had in the case of surges, but there has been little trouble of this kind in America. Foreign engineers use water jets and other devices and hold certain objections to the aluminum arrester. He considered the status of the aluminum arrester quite secure, for although it has limitations in current capacity, etc., they are outside of the usual limits of practice.

This paper was discussed by E. B. Rosa, V. Karapetoff, F. W. Peek, Jr. L. C. Nicholson, C. O. Mailloux and C. P. Steinmetz.

Mr. Nicholson stated that the aluminum arrester usually behaved well and the stations equipped with them value them highly, while others seem to get along all right without them. There is no trouble in keeping them in operation. He favored the use of a charging resistance in series. Most trouble from lightning, however, occurs at some point out on the line where the lightning arrester is not involved. Dr. Steinmetz stated that the lightning arrester sometimes gives protection and sometimes does not. If there is a high-frequency surge of too low voltage to jump a spark gap, it may still mass up across reactance and hence do damage, as to the first coil of a transformer. A steep wave front sometimes has a similar effect. Condensers, such as the Mossisky type used in Europe, apparently short-circuit on high frequency, but do not absorb energy. Conditions which are suitable for a condenser of practical size are rather rare. When a high voltage arises in a station where there is inductance and capacity in circuit such a shunted capacity may be useful. The value of a capacity in protective devices is merely to act as a barrier against the normal frequency, when placed in series with a resistance, which is the element really giving protection by absorbing the energy which flows at high frequency. The aluminum arrester is a condenser which at high frequency and high voltage has unity power-factor. Its action is similar to that of a storage battery on a 600-volt direct-current circuit. He drew an analogy between the lightning arrester and the steam safety valve. In either case the shock of discharge may cause a breakdown. A critical resistance in the circuit may hold the voltage on the line long enough to produce damage. The steepness of the wave front depends upon the distance from the point of origin. This is found by experience much different from the ordinary theory, owing to the fact that the theory has been worked out on assumptions which do not hold, since the resistance, for instance, depends upon the frequency.

After a few closing remarks President Mailloux then adjourned the convention.

THE GOVERNMENT AND BUSINESS ADMINISTRATION.

By Guy E. Tripp.

At the meeting of the National Chamber of Commerce at Washington, D. C., on February 12, Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, delivered an address on the pending "anti-trust" legislation. Mr. Tripp said in part:

"Whether it is economically sound or not, the public has the belief that practically all business should be roughly divided into two classes, the one comprising the natural monopolies of public necessities, in other words, public utilities, the other comprising the naturally competitive private business undertakings. Personally, I find no fault with such a division, but manifestly these two distinct classes require different legislative treatments.

"That public utilities should be regulated and not given the free hand that naturally competitive business requires, is sound doctrine, but only when such regulation carried with it an obligation to protect such utilities against the menaces which confront competitive business. If we restrict opportunities, we must reduce the risks.

"Almost nothing has remained unthought of in the way of regulation and restriction, and the cheerfulness with which regulatory burdens have been heaped upon our public utilities is discouraging, when it is remembered that hardly a single voluntary act for protection has been heard of.

"Public utilities should be protected against competition, inadequate rates, demands for excessive service, unreasonable and, unjust damage claims. Federal regulations superimposed upon State regulations, and, most important of all, against oppressive demands of labor. Under present conditions, the mere threat of a labor strike on a railroad is sufficient to almost automatically produce an increase in wages, or cause railway managers to relinquish their right to enforce discipline in the interest of the safety of the public and economy of operation, as instanced by the recent strike on the Delaware & Hudson Railway. The best evidence that our legislators have abandoned their campaign of punishment and have become sincerely desirous of doing the fair thing by our public utilities will be shown when someone has the courage to introduce a bill intended to effectually prohibit strikes and lockouts on railroads.

"The various railroad securities bills which have been proposed almost wholly ignore the investigations of the Hadley Securities Commission which recommended first of all that publicity be required and pointed out objections to any further regulation of securities until publicity had shown what might be needed. However, we already have State supervision of railroad securities quite generally, and I believe that Federal supervision would be found an improvement, provided it supersedes that of the states. I have not heard it suggested, however, that the State's right in this respect could or would be taken from them, therefore superimposed regulation may be imminent and such a condition is justly to be feared by the railroads.

"While, therefore, railroads and other public utilities need special legislation for both regulation and protection, a naturally competitive business (like that in which I am engaged) stands on an entirely different basis, and, if competitive conditions are maintained for it as I believe they should be, neither regulation nor protection of the character just mentioned has any place in its dealings with the government.

"If one cannot manufacture his goods and sell them as cheaply as his competitor can, he must eventually fail; and if his employees force him to the issue, he can shut up his shop and both he and his employees will be out of income for a longer or shorter period, but the general public welfare is not vitally affected.

"A great deal of the proposed legislation at Washington is directed toward creating or maintaining conditions which, in the minds of the legislators, will tend to insure competition among this class of industries which, as I have said, are to be distinguished from public utilities. In so far as these measures will be effective in the direction of securing sane competition, I believe they are wise.

"Monopoly is not in itself objectionable; in fact, it is often the most effective way of dealing with industrial affairs. In Germany it is fostered and protected by the government to a large extent, with the result that the commercial supremacy of that country in the markets of the world has been established within a comparatively few years of the most rapid business growth perhaps that has ever been seen.

"But I believe that our political institutions and the temper of our people are not adapted to monopolistic methods that are in restraint of trade, and that fair competition in business will make a more contented public, a more secure government, and in the end give greater protection to property.

"Therefore, I am in favor of all fair and reasonable legislation sustaining that theory.

"Fair or sane competition is hard to define.

"To my mind free competition is not sane competition.

"The biggest business in the country was founded almost entirely upon the principle of free competition, namely, that of making prices what and when you will and taking all the business from your competitor that you can. If this business was a monopoly, it grew to be so without the aid of interlocking directorates or the alleged money trust; it became a monopoly simply by the practices of free competition.

"Therefore, in considering the various business measures now pending, particular attention should be given to the question: Will they, or will they not, assist in securing sane competition, not free competition?

"The five bills now proposed are, viz.:

"An Interstate Trade Commission bill.

"An Interlocking Directorates bill.

"A Sherman Law Definition bill.

"A Trade Relations bill.

"An Anti-Holding Company bill.

"It is not my purpose to attempt a detailed discussion of these measures, for in the details lie endless differences of opinion, many real and imaginary dangers, and much sincere and insincere befogging of the issues. I believe that the safest viewpoints for the busy citizen are:

"First, Are they based upon the right principles?

"Second, Is it probable that acts can be framed which will sustain these principles without doing more harm than good?

Trade Commissions Bill.

"A trade commission seems to me to be needed in a well rounded plan of business legislation.

"No other agency can so well collect information, conduct investigations, and determine facts for the guidance of the legislature and courts, and that in the last analysis is all the power that the bill gives it.

"No great harm can come from elaborate powers given the commission in the way of getting papers and documents except expense and bother to the corporations.

"It would be a physical impossibility for it to exercise its full powers in this direction, hence it is futile to make statistics as to how many freight trains it would take to convey the papers to Washington.

"I object to the provision that the commission may from time to time make public such information in such form and to such extent as it may deem necessary. There is danger of telling our competitors too much and giving half-truths to the public. It is unnecessarily harsh publicity and I hope the bill will finally be toned down in this respect.

The Interlocking Directorates Bill.

"This bill attempts in four short sections to say who shall not be directors in corporations, to the end that competitive conditions shall be created and preserved.

"In my opinion, as at present drawn, it will wholly fail in its object and will foster the very thing that it aims to prevent.

"It will tend to create dummy boards and enable responsible men to exercise as much control as ever without the restraining influence of personal responsibility.

"It will tend to create one man power corporations and thus render more unstable the investments of the public.

"It is based on a mistaken or exaggerated notion of the Machiavelian activity of the interlocking director.

"I have been in business all my life and I have no hesitation in saying that those terrible charts of control through interlocking directors are worse than worthless.

"As an instance, enough misinformation has been gleaned from them to bring out the statement that the General Electric Company and the Westinghouse Electric & Manufacturing Company are only alleged competitors. I say that is untrue.

"If the whole interlocking directorate bill should be wiped out except the last section, and that should simply provide that the fact of a common director shall be prima facie evidence instead of conclusive that no competition exists between two corporations, it would probably be ample to cover the situation. In its present condition the bill is likely to do much more harm than good.

The Sherman Law Definition Bill.

"This bill defines certain acts as restraints of trade which now are interpreted by the courts one way or the other as they are more or less small and insignificant.

"It is said by the lawyers that under this bill as now drafted no concern could enter into an agreement with any labor union. If this is so, I imagine it will be promptly changed.

"It is also said that the bill imposes upon every concern, no matter how small, weak or insignificant, the same prohibitions which the Sherman Act as now interpreted provides shall be applicable only to concerns so large as to threaten competition.

"This is a bill for a laywer to interpret; but, if it defines with precision what a corporation officer may or may not do to escape criminal prosecution, it will be an improvement upon the present uncertainty.

"However, a careful reading of its very short and concise paragraphs leaves one with a feeling that the definitions are fully as vague as the Sherman Act itself; and, instead of improving, it further complicates a situation which has begun to be clarified.

Trade Relations Bill.

"This bill makes it a violation of the Sherman Act to discriminate in price, for the purpose of injuring a competitor or to fix a price upon the understanding that the purchaser shall not deal in the goods of a competitor, and prohibits mines from refusing to sell to responsible people who apply to purchase.

"The prohibition against discrimination in prices is intended to create sane instead of free competition and I think may prove to be a good provision.

"As to prohibiting the fixing of prices upon the understanding that the purchaser shall not deal in the goods of a competitor I do not view that as revolutionary although it might cause inconvenience to some to adjust themselves to it. On the whole, I think it is fair.

"The provision concerning mining companies is aimed to do away with price fixing, but I am not sufficiently familiar with that business to say how it would work.

"It seems to me that there should be included in this bill a provision such as that recommended in the report of the Committee on Interstate Commerce from which I quote:

"'There ought to be a way in which men in such a venture could submit their plan to the government and inquiry made as to the legality of such a transaction; and, if the government was of the opinion that competitive conditions would not be substantially impaired, there should be an approval, and insofar as the lawfulness of the exact thing proposed is concerned there should be a decision, and if favorable to the proposal there should be an end to that particular controversy for all time.'

"Section 13 of this bill, which permits any person to sue out an injunction against threatened loss or damage, might subject a large company to a multitude of strike suits. It should certainly be amended.

Anti-Holding Company Bill.

"I have never seen a draft of this bill and I believe none has been printed, so a consideration of it is somewhat premature, but it is to my mind fraught with more danger than any other of the business bills recently proposed.

"It will be impossible to prohibit all holding companies without financial disaster, and just how the good can be separated from the bad in an act of Congress I cannot imagine.

"Public utility holding companies, for example, are sound in principle, even though some are not so in practice.

"Practically all large corporations are holding companies to some extent and in many cases they are compelled to be so by the operation of state laws.

"This bill deserves the most careful analysis and its final draft will be looked for with great interest.

"Such a brief summary of these bills is entirely inadequate for any other purpose than to point out the extent to which the federal government proposes to regulate the business affairs of the country, and I have some fear that the impression which will be conveyed by the views which I have expressed will be one of doubt as to whether I am a reactionary or a progressive. I believe no good results can be obtained through wholesale condemnation, and I do not fear the principles which I have outlined, but I do fear the unknown dangers of untried legislation and should have preferred to see such vital changes tried one at a time; but, if that cannot be, I hope the government will finally resolve all doubtfully dangerous provisions on the side of intimidated and apprehensive business interests."

Utah Society of Engineers Hears Talk on Radium.

L. O. Howard, a Salt Lake mining engineer and associate editor of the *Salt Lake Mining Review,* gave a talk at the regular meeting of the Utah Society of Engineers at its regular meeting at Salt Lake City on February 20, on the development of Utah radium-bearing ores. Mr. Howard said that through discussion in technical and popular magazines, doubtless propagated to a great extent by the publicity furnished by the Bureau of Mines and the recent hearings before a congressional committee on the question of withdrawal of control of the radium-bearing lands as yet unlocated on the public domain, radium has become a matter of much interest to layman as well as scientist. It has been the inevitable result of so much publicity that the public has been grossly misinformed on the subject, both as to the condition of radium therapeutics and with regard to the extent and value of our ores. Concerning Utah deposits little has been published of a reliable nature and the bulk of the people are unaware of the position that Utah has today in the furnishing of ore for radium production.

The impression has been general that we had to look for our radium to Europe; that we did not know how to make it in this country; that the well known ability of foreign chemists has placed America in a humilitating position. It is, however, no longer necessary to depend on a foreign sup-

ply. We are today making radium in our own plants in comparatively large quantities.

In connection with the radium in our ores there are two other metals of considerable importance—uranium and vanadium. In Utah the ores of vanadium, uranium and radium are found in several localities in the eastern section. The ore occurs in a sedimentary formation. The beds have suffered considerable erosion, but when this has not been too deep, a thin bed of quartzite lies on the highest portions. Beneath this is a medium coarse to fine conglomerate. Beneath the conglomerate lies a coarse-grained white sandstone, underlaid by a thin seam of green shale.

The ore is found principally as an impregnation of the sandstone and lies in any part of the same near the surface, sometimes immediately underneath the conglomerate, at others on top of the shale. The conglomerate is sometimes the source of valuable ore and occasionally the quartzite shows a slight mineralization. The principal mineral is the canary-yellow carnotite, whose color is often obscured, and a variety of earthy minerals usually accompany it. The various minerals present a startling array of colors—black, all shades of green, yellow, blood red. The black is sometimes glossy, like coal, sometimes talcy, and sometimes dull earthy. These are usually the best grades of ore. It occurs in pockets from a few inches up to five or six feet thick. Utah has an undoubtedly large resource in carnotite ores.

Radium, as put on the market, comes in the form of a radium-barium chloride, and not in the metallic state. A certain amount of radium contained in a relatively large bulk of the salt is just as effective as the same quantity would be in the metallic state and, in addition, some bulk is given by the radium preparation so that it is easily handled, divided or applied, and the useless cost of producing the pure metal is avoided.

The price at which radium sells at present ranges from $120 to $180 a milligram of metallic radium. Price is dependent on several factors, chief of which is the quality of the product. Closely connected with this factor is that of the responsibility of the seller.

Exports of Copper.

During the month of January, 1914, the exports of copper from this country amounted to 36,018 tons, compared to 25,026 tons in January, 1913. During the first half of February the copper exports totaled 18,602 tons; for the week ended February 26, 3,950 tons.

A Severe Storm in Los Angeles and Vicinity.

A storm of unprecedented violence, attended by the heaviest rainfall ever recorded in the history of Southern California, broke over Los Angeles on February 18, and continued without abatement until midnight, February 22. In all, 7.4 inches of rain fell in the City of Los Angeles, and some of the suburban towns registered a fall of 12 inches.

The flooding of rivers and other natural and artificial drains was responsible for serious damage to private property, and to city and county streets and bridges; while the public-utility corporations have reported heavy losses from curtailed revenues due to inability to operate, and to plant destroyed or damaged.

Recent estimates of the damage sustained by various interests are as follows:

Damage to private property	$ 500,000
Cost of repairing city streets and bridges	60,000
Cost of rebuilding county roads and bridges	75,000
Losses sustained by steam roads	1,250,000
Losses by interurban electric railways	125,000
Losses by city electric railways	25,000
Losses by power, telephone and telegraph companies	65,000
Total	$2,100,000

On Saturday morning, February 21, the Pacific Electric Company, which handles the interurban traffic out of Los Angeles, found it impossible to move a car, owing to wrecked bridges or washed-out roadbeds. By noon of that day, its line to Pasadena was in operation and other lines began coming in from time to time as temporary repairs were made. It was necessary for some time to have passengers make walking transfers at points where bridges have been totally destroyed, or where there has been a complete failure of the road bed.

From 6 a. m. to 9 a. m., all cars of the Los Angeles Railway Company, which handles the city traffic, were stalled, due to the washing out of pole lines between the Pacific Light & Power Corporation's substation and the railway company's net work.

The Southern California Edison Company's 60,000-volt steel-tower line running between the Long Beach steam plant and Los Angeles was washed out by the flood waters, and several towers of the Kern River 60,000-volt line, which runs along the bank of the Los Angeles River within the city limits, were destroyed. The Kern River plant is the Edison Company's largest hydroelectric development.

Aside from the destruction of some of its distributing lines, one of which is noted above, the Pacific Light & Power Corporation came through the storm in good shape. Its new 150-000-volt line, 275 miles in length, running from Big Creek to Eagle Rock, just outside the city limits of Los Angeles, recently constructed by the Stone & Webster Corporation, remained in service and was the only source of power for the railway companies for a considerable period of time.

The Pacific Telephone & Telegraph Company's long-distance lines were out of service to San Francisco, Santa Barbara, Bakersfield, San Bernardino and Arizona points. The line to San Diego was the only one intact. Long-distance service was restored to all points except Bakersfield by Sunday night, February 22. The Western Union Telegraph Company and the Postal-Cable Telegraph Company were handling no business, with the exception of one wire to Chicago.

Normal conditions as to service were soon restored, but it will be several months before permanent repairs can be completed.

Census Report on Telephones.

Preliminary figures of the forthcoming quinquennial report on telephones of the United States have been given out by Director W. J. Harris of the Bureau of the Census, Department of Commerce. They were prepared under the supervision of W. M. Steuart, chief statistician for manufacturers.

The statistics relate to the years ending December 31, 1902, 1907, and 1912. They include the total wire mileage and the total number of telephones reported for all systems in the United States that were in operation all or any part of those years. They do not include private telephone lines used exclusively for communication between different departments of the same establishment unless connected with lines elsewhere through a private or branch exchange. The number of telephones includes all installed, including those furnishing service through private branch exchanges, local pay, and outlying toll stations.

During the year 1912 the length fo wire used on the telephone lines of the United States amounted to 20,248,326 miles. This represents a gain of 15,347,875 miles during the decade, or an increase of 313.2 per cent; there were 8,729,592 telephones in use, or 6,358,548 more than the number reported for 1902, an increase of 268.2 per cent.

The number of telephones reported

by the Bell Telephone System increased by 137.8 per cent during the period from 1902 to 1907, and by 62.4 per cent from 1907 to 1912. During the same periods the number of telephones reported by all other companies and systems increased by 183.4 per cent and 22 per cent, respectively. In 1902 the Bell System controlled 69.1 per cent of the wire and 55.6 per cent of the telephones in use. In 1912 this system controlled 74.7 per cent of the wire and 58.3 per cent of the telephones. The proportion of the total wire mileage and total number of telephones owned by the Bell Telephone System has increased during the decade, while that owned by the independent companies has decreased.

The purpose of telephone companies is to afford communication between distant points, and the amount of business is usually expressed by the number of separate messages or talks that pass over the wires. While some companies keep an accurate account of the number of messages, as a rule no record is made from which accurate statistics can be compiled. It is estimated that there were 13,735,658,245 messages or talks sent over the telephone lines of companies which had an income of at least $5,000 during 1912. A message may represent either a few words or a long conversation, and therefore does not indicate the extent to which the equipment is used. It was impossible to obtain even an estimate of the number of conversations over the private branch wires and the party lines which do not require interconnection at the public or central exchanges. No estimates were required concerning the number of messages for the 1,402,844 telephones on the lines of small companies which had an income of less than $5,000 during 1912. Messages for these smaller systems were included to some extent in the census of 1902; therefore the statistics of messages reported for the three years are not strictly comparable, and they should not be considered as representing the total amount of business transacted by telephone systems of the United States during the year 1912.

The figures in detail are shown in the following table:

	Year.	Miles of wire.	Number of telephones.	Estimated number of messages or talks.[1]
United States	1912	20,248,326	8,729,592	[2]13,735,658,245
	1907	12,999,364	6,118,578	[2]10,400,433,958
	1902	4,900,451	2,371,044	5,070,554,553
Bell Telephone System	1912	15,133,186	5,087,027	9,133,226,836
	1907	8,947,266	3,132,063	6,401,044,799
	1902	3,387,924	1,317,178	3,074,530,060
All other companies and systems	1912	5,115,140	3,642,565	4,602,431,409
	1907	4,052,098	2,986,515	3,999,389,159
	1902	1,512,527	1,053,866	1,996,024,493

1 The number of messages reported by the Bell Telephone System includes only completed calls, while the figures for all other companies may include some original calls not necessarily completed; such as calls that the operator reports as "Line busy" or "Does not answer."

2 Exclusive of companies with an annual income of less than $5,000.

Electrical Features of New Terminal in Minneapolis.

The new $2,000,000 Great Northern Railway Station in Minneapolis, Minn., which was opened for service January 22, is claimed to be the final word in modern terminal construction. It stands on the river-front facing Hennepin Avenue. The main building has its entrance on the street level. The waiting room is 62 by 155 feet, and the concourse 252 by 50 feet, with stairways and elevators leading to train platforms.

The electrical equipment of this new Great Northern station is said to be the finest in the Northwest, as well as the most extensive. More than eleven miles of galvanized iron conduit was used, and more than 25 miles of rubber-covered wire. All of the wire used in this installation is of a quality better than standard adopted by the National Board of Underwriters, the insulation being 30 per cent pure para rubber.

New Railway Terminal in Minneapolis Using Electricity on a Large Scale.

The main waiting room and train concourse are lighted by large ornamental chandeliers with tungsten units. In the new depot, Minneapolis people are given their first sight of recessed lights at the base of all stairway landings, minimizing mis-steps in going down these stairways.

More than 500 switches are used for controlling the various lighting circuits in addition to which there are a number of remote-control switches for controlling groups of lights from various remote locations in the station. All of the remote-control points have small lamps back of a bulls-eye lense to indicate if the lights located at a remote point are burning, or are cut off.

The powerhouse, for furnishing the light, heat and power to the station, is located approximately 1,000 feet north of the building, the wires for supplying light and power and the steam for operating pumps and for heating purposes being carried through an aerial passage-way connecting the two buildings.

The generating plant consists of two simple and one compound engine being directly connected to two 25-kilowatt and one 350-kilowatt direct-current 220-volt generators, making a total of 850-kilowatts. The switchboard for the control of this machinery consists of a six-panel slate board 15 feet long, located along the west wall of the engine room. This is equipped with all the latest instruments for determining the voltage of the generators, the load under which they are operating, and the total amount of current supplied to the building during any given interval.

All of the electrical equipment, including generators, switchboards, panel-boards, conduit and wiring, was installed by the Minneapolis Electric Equipment Company.

Washington Office for National Independent Telephone Association.

In order to be able to keep in close touch with the Interstate Commerce Commission and with other Federal authorities concerned with interstate telephone business, the National Independent Telephone Association has established an office at Washington, in charge of F. B. MacKinnon, secretary of the Association. Through this office every effort will be made to cooperate with the Federal Government in the investigation and regulation of long-distance telephone business. The address of the office is Rooms 526 and 527, Colorado Building, Washington, D. C.

New Electrical and Mechanical Appliances

The Cutler-Hammer Snap-Switch Line Extended.

To the original rectangular and round-base snap switches known as Nos. 7,102, 7,103, 7,107 and 7,108, the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has added a number of new styles making the line complete for use with all wiring systems. The six new styles are designated as catalog numbers 7,109 to 7,114, inclusive. A new and important feature is provided on all the circular-base type switches. This is a snap-locking cap which eliminates the use of screws and saves time in installing. There are two small slots in the side of the cap diametrically opposite each other and near the push-buttons. These slots engage with two nibs se-

Push-Button Snap Switch with Slotted Base.

cured to the base. To remove the cap, the sides are pressed together and upward which produces a bulge and allows one slot to be released from its nib. The cap is replaced by first engaging one slot, then pressing the sides so that the other slot slips over its nib and locks in place. No screws need be handled and no time is lost.

The same simple push-button mechanism is used which makes unnecessary the rotating button at the front of the switch. All the switches are indicating, as one button is dark and the other light. The caps are furnished plain or with a label holder for designating the circuit or lamps controlled.

Electrically Driven Collier "Jupiter" Makes Good Record.

The electrically driven collier *Jupiter* has scored a signal success on her trial trip, just completed off the Lower California coast. Though rated as a 14-knot boat, she maintained an average speed of 15.1 knots for 48 hours, during which time the electrical machinery revolved the propellers at the rate of 115.7 revolutions per minute, developing 6,940 horsepower.

This is the first time the system of electric propulsion has been tried on any naval vessel, and the department officials are greatly pleased at the result. The *Jupiter* was, in competition with the collier *Neptune*, fitted with a reduction gear calculated to bring the

Push-Button Switch with Metal-Molding Base.

speed of her turbines down to the point of economy by gearing, and with a third collier—the *Cyclops*—fitted with reciprocating engines. All three vessels were of the same size and similar lines, and the *Jupiter's* performance, which exceeds that of the two others, may have an important bearing on future naval design.

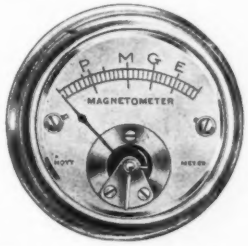
Hoyt Magnetometer for Testing Ford Automobile Magnetos.

Magneto troubles are a frequent source of annoyance to the motor-car user. The advantage of using a magneto on account of the simplicity of the arrangement is appreciated by many motorists and this has created a demand for some means of indicating whether the magneto is in good working condition.

To meet this need the Hoyt Electrical Instrument Works, Penacook, N. H., has developed a form of magnetometer designed particularly for use with model T Ford cars, which have become so popular.

The magneto used in these cars has met with much favor on account of its simple arrangement and reliability of operation if kept in reasonably good condition. By the use of the Hoyt instrument a simple check is kept on the condition of the magneto. The instrument itself is but two inches in diameter and is designed to be fastened to the dashboard of the car. It is permanently connected to the magneto so that at all times it indicates the magneto output.

An exhaustive series of tests with the magnetos used on this type of Ford car show that they usually slowly reach a point at which the magneto, although generating, does not satisfactorily ignite the charge. This point is indicated on



Instrument for Testing Ford Automobile Magnetos.

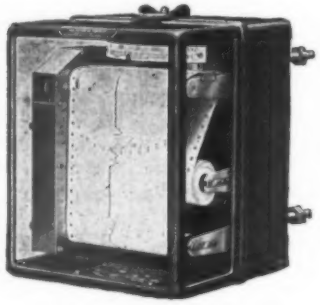
the scale of the new instrument by the letter "P", meaning poor. Another point at which the magneto will operate without skipping but ignites the charge rather slowly is indicated by the letter "M", meaning medium. The lowest point at which efficient ignition takes place is indicated by the letter "G" for good. The most perfect condition is indicated by the letter "E" for excellent.

In installing the Hoyt instrument it is not necessary to disturb any of the regular wiring of the car. It is readily installed and does not require an expert electrician for this purpose. Its use serves to inform the car user when the magneto needs attention and its indication also gives a clue as to the nature of the trouble. The instrument is constructed of high-grade material; its construction is such as to make it little liable to change.

Esterline Graphic Meters.

A complete line of continuous curve-drawing instruments has recently been completed and placed on the market by The Esterline Company, Indianapolis, Ind. These instruments are now furnished for the measurement of all electrical quantities, such as volts, amperes, watts, etc. Electric speed recorders, service recorders, pyrometers and graphic counters are also included in this line.

These meters are furnished in switchboard rear-connected type, wall or front-connected type, and in the portable type.



Switchboard Curve-Drawing Instrument.

The general construction of all these types is the same with the exception of the case and the method of making connections. The clocks, meter elements and recording mechanism are the same in all types.

These instruments are of the direct writing type. The pen is in contact with the paper at all times when writing. It is placed in the end of a tubular pointer which is pivoted and provided with a counterweight. The pressure of the pen on the paper is regulated by this counterweight which is adjusted so that there is just sufficient pressure to hold the pen on the paper without creating heavy friction.

The ink supply is retained in a stationary well provided with a cover to prevent spilling of the ink when instruments are moved about. This ink well is located just in front of the armature staff. The tubular pointer is provided with a crook at the back end which dips down into the ink well. The ink, after being started through the pointer and pen, will continue flowing due to capillary action as long as the ink supply lasts. This construction results in a light moving element and constant friction no matter how much ink there is in the instrument.

The clock is of the eight-day jewel-balance-wheel type. It is provided with two driving springs and a third spring which operates the rerolling device provided for winding up the finished chart. On some types the reroll is omitted and the finished record allowed to feed through a slot in the bottom of the case. The clock is fitted with a driving roll equipped with pins at each end which engage perforations along the margin of the record chart. The driving roll is geared through the two idlers to the clock stud which furnishes the driving power. Different combinations of gears are supplied so that five chart feeds, 0.75, 1.5, 3, 6 and 12 inches per hour, may be obtained on any clock by putting on the proper gears. For furnishing rapid chart feeds, a special attachment is provided on the clock, arranged so that shifting a small lever on the front of the clock case instantly changes the chart feed from a given number of inches per hour to the same number of inches per minute. The clock is mounted in a dust-proof case and attached to the door, which in turn is held by four screws.

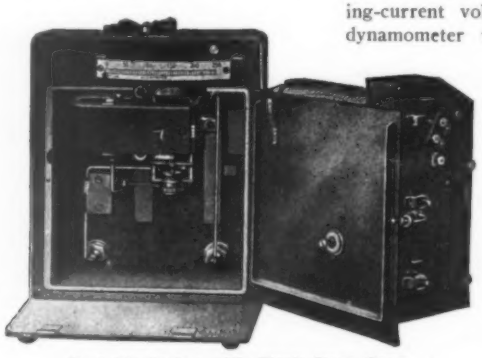
Meter elements are assembled complete in one unit and may be removed from the instrument without dismantling. For direct-current ammeters and voltmeters a powerful D'Arsonval permanent-magnet type movement is used. For direct and alternating-current wattmeters, alternating-current voltmeters and ammeters a dynamometer type construction is employed. No iron is used in the magnetic fields of the dynamometer movements so that meters of this type are accurate on all frequencies and respond promptly to voltage or load variations. The armature shaft of the meter element is provided with a bracket which carries pivots in which rest the pointer carrying the pen.

Record charts are of continuous web or tape type being 6 inches in width and having a ruled portion 4.5 inches wide. The time divisions are in the nature of arcs across the paper spaced 0.75 inch apart. Range numbers are provided across the chart to facilitate interpretation of curves. Hour numbers corresponding to the gears on the clock are printed along margin opposite the time arcs. Voltmeters are furnished with suppressed-zero scales ranging 90-140 volts or standard scales 0-150 volts. Direct-current ammeters are also furnished with the suppressed-zero scales for special uses or may be furnished with zero-center charts for battery charging or other applications where reverse currents are encountered. Indicating scales are provided above the record charts so that meters may be used either for indicating or curve-drawing purposes. Record charts are of sufficient length to last two weeks at three inches per hour.

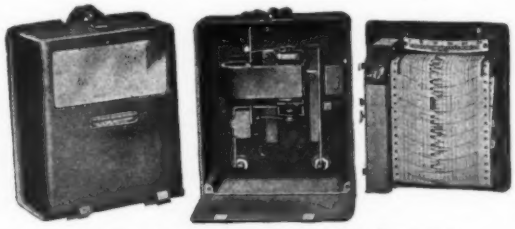
Portable Curve-Drawing Instrument.

Alternating-current instruments are provided with adjustable damping devices consisting of a rotating vane immersed in a small cup containing oil or some other viscous liquid. The amount of damping is varied by adjusting the height of the cup, the quantity of oil or the quality of the liquid. Direct-current meters do not require damping as the armature is wound on a metallic frame in which eddy currents are induced when the armature rotates in the magnetic field of the permanent magnet.

The power consumption on these instruments is so low that they may be operated from shunts or transformers already installed. Voltmeters and wattmeters require from 4 to 5 watts for each voltage element on 110 volts. Direct-current ammeters consisting of millivoltmeters and shunts require only about one-third ampere for the instrument. Due to the direct writing construction, no extra con-



Portable Meter with Clock Door Open.



Portable Meter—Cover and Clock Removed.

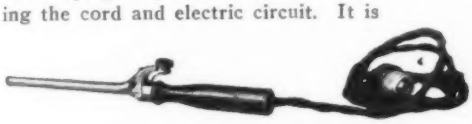
trol circuits of any sort whatever are made use of.

These instruments are used on switchboards for obtaining voltage and output curves. They are used for getting power consumption of motor-driven tools and for general efficiency engineering. These instruments are especially valuable when it is desired to get an accurate record of power consumption in circuits where the load is fluctuating very rapidly.

Westinghouse Electric Curling Iron.

A new electric curling iron is being manufactured and sold by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. This curling iron can be used with stored heat, as with the flame-heated curling iron. In addition, it can be used with continuous heat, a use which cannot be obtained with the flame-heated iron.

For use with stored heat, the iron is first heated by connecting it to the electric circuit. When it is hot, the swivel plug is pulled out, disconnecting the cord and electric circuit. It is



Electric Curling Iron Complete.

then like the ordinary curling iron and is used in the same manner. When it gets cold, the plug is pushed into place until it is hot again.

When it is used with continuous heat, the swivel plug enables the user

The Three Main Parts of the Electric Curling Iron Disassembled.

to grasp the iron in such a way that it can be freely rotated by the thumb and fingers without twisting the cord. It can be used with or without the hair clamp, which is easily removable.

This iron is said to be the result of long study and experimentation. It is claimed to be exceptionally simple, reliable and rugged in construction. The heating element is in the form of a rod inserted directly into the barrel. It can be removed by loosening two screws in the handle. In case the heating element burns out from misuse, it can therefore be replaced with less than five minutes' work. The heating-element terminals are positive in action, there being no possibility of loose contacts. The swivel plug, which fits into the end of the handle, is formed of specially prepared molded composition and will not break if dropped. In this plug are carried strong spring contacts which make connection with the terminals of the heater. The cord is attached to these contacts within the swivel plug. There are no exposed terminals and hence no live parts.

As the input is only 15 watts, it costs only about one-tenth of a cent an hour to use this curling iron with the average price for current.

All metal parts are nickel plated and highly polished. The handle is of wood, black-ebony-finished and highly polished.

The Red-Top Drive Anchor.

With the approach of spring, electrical companies operating overhead circuits are planning their new construction work and also considerable reconstruction necessitated by the violent storms of the last few weeks. In all such work the proper guying of lines calls for the use of many earth anchors.

Of the newer types of anchors suitable for light construction work, one that has been meeting with much favor is the Red-Top drive anchor manufactured by the Universal Cable Grip Company, Syracuse, N. Y. This is an extremely simple anchor, consisting of but three parts; these parts are so joined that they come all ready for use without need for assembling and without danger of loss of any part in shipment.

Front and Side Views of Red-Top Anchor in Driving Position.

The rod forming the central part of the anchor is made of special high-carbon steel and has a simple forged shoulder near the lower end and an upset top end. This rod is used both for driving the anchor into the ground and as the guy rod for holding the strains. Driving is very easy in any kind of soil and requires no special tools.

A combination driving point and slug is so shaped as to fit on the rod and offer both a sharp point for driving and at the same time but little resistance to driving in its body. The point is shaped to form a socket for the lower end of the rod so that the driving blows on the rod are transmitted directly to the point. The body of the slug is curved and corrugated to offer great resistance to bending or distortion under strain.

The third part of the anchor is the swivel thimble at the top. This replaces the forged eye in the rod and the galvanized thimble of the ordinary anchor. The thimble forms a serviceable and very convenient means for attaching the guy strand. Its swivel arrangement permits the natural turns in the guy to twist out when the strain is placed on it. The swivel thimble is finished in bright red waterproof enamel; from this the anchor gets its name "Red-Top"; since this red thimble is always above the ground, it serves as a constant warning against stumbling over it.

Red-Top Anchor with Slug Transversely Extended as It Is in Service.

In the first two views herewith are shown front and side views of the anchor in driving position. When the anchor has been driven in place and the guy strand slipped over the swivel top, pulling up on the guy causes the shoulder of the rod to draw up against the hole in the slug. The latter therefore begins to curve out and presently assumes a position at right angles to the rod. Beyond this it cannot turn on account of the shape of the slug.

The latter position is shown by one of the illustrations, which makes clear why the Red-Top anchor has a strong holding power with its maximum surface transverse to the strain.

New Wireless Stations.

Two high-power wireless stations have been opened at the extreme north and extreme south of New Zealand.

Instrument Posts for Electrically Operated Control Outfits.

Instrument posts are used whenever a device is required upon which to mount meters in a power station in place of using an instrument switchboard. The wiring is concealed in the interior of the posts. The advantages of instrument posts over panel switchboards are that they permit a very convenient and ornamental mounting for meters, besides locating them in such a position that they can readily be observed without obstructing the general view of the operator.

The usual arrangement is to place these posts so as to form a support for the railing of an operating gallery, each post being placed in front of its respective controlling apparatus which is usually located on a suitable controlling pedestal.

The posts may be secured to the floor either by bolting the shank to the side of channel-iron beams located under the floor, or by using a bolted flange collar, secured to the post and provided with holes for holding down bolts. When a concrete floor is provided, a socket can be supplied which may be set into the floor, and which is arranged for bolting to the flange collar. Standard ornamental posts have plates provided at the places where hand railing is usually attached, but when required hand-rail bosses may be substituted. These bosses are drilled to take a standard two-inch pipe. Posts with panel bases are not arranged for hand railing. Standard posts are finished in dead black. The posts having paneled bases are supplied with panels of slate with black marine finish.

Two styles of pedestals are made, with ornamental bases and with paneled bases suitable for mounting control apparatus. Each of these styles is also made with stationary top and with swivel top which can be turned about by means of a handwheel just above the base. These instrument posts are manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Stationary Instrument Post with Ornamental Base for Railing.

Swivel-Type Synchroscope Post with Ornamental Base.

Instrument Post with Paneled-Slate Base.

Electric Power for Freeport, Tex., from Sulphur Mine Plant.

Freeport, Tex., is soon to have a new electric lighting and power system suitable to meet the needs of this growing seaport. In connection with the new superheated water and power plant now being installed at the Freeport Sulphur Company's mines at Bryan Heights, a new central electric power plant has been recently included in the plans, and will be installed in the next few months. This plant through transmission lines, it is announced by the company, will supply electric light and power to Freeport.

The amount of electricity furnished will be ample for the city, meeting all the requirements of the present and for some time in the future. It will take the place of a much smaller plant now in operation here, and do away with the need for any larger plant being installed in the city for a number of years to come.

The electric current which will be furnished to Freeport and the sulphur mines from this central power station will be generated by a 200-kilowatt Westinghouse steam-turbine generator set. This central power station will be ample to do all the work at the mines at Bryan Heights, in which electric power can be used, such as operating electrically driven pumps to pump water from the canal, and fuel oil from the storage tanks on the Freeport ship channel to the mines, providing power for the machine shop and for commercial and domestic lighting and power at Freeport. The station will be installed by Westinghouse, Church, Kerr & Company, of New York City, in connection with the other new $125,000 developments now being put in at the mines by the Sulphur Company.

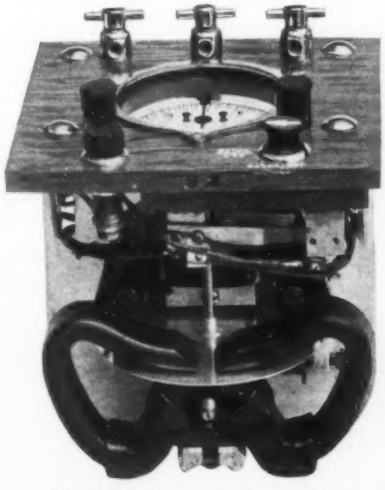
The new sulphur conveyor and loading devices installed by the Sulphur Company at the Seaboard & Gulf Steamship Company's pier on the Freeport ship channel, which has a capacity of 3,600 tons per day for loading vessels with sulphur, is now completed, and ready for operation. It is expected that the first shipload of sulphur to be loaded and shipped from this port will leave here on one of the Seaboard & Gulf Steamship Company's boats within a few weeks. A new loading equipment for handling this product at the mines has also recently been installed and is now in operation. It consists of a Brown hoist, with a loading capacity of 30 carloads of sulphur a day.

Electrically Operated Valves for New York High-Pressure Pumping System.

Three electrically operated valves are now being installed in New York's high-pressure fire system. One of these valves, which is located at Stone and Whitehall Streets, is an accessory to the duplex system and the other two, one at Hudson and North Moore Streets and another in the Bowery just a little south of Houston Street, are for the purpose of separating or uniting the two pumping districts. The last two mentioned are a notable improvement in the system and would demonstrate their enormous value in case of a break in one of the mains. The engineer in either pumping station could, by throwing a switch, instantly separate the two districts until the broken part could be isolated, without interrupting the service in the unaffected district. On the other hand, if either of the pumping stations should be crippled the valves could be opened and the entire high-pressure systems supplied by the working stations.

Each valve is operated by a five-horsepower motor located in the vault beneath the street. The Hudson and North Moore valve is controlled from the pumping station at Gansevoort Street and the North River, while the valve in the Bowery is controlled from the station at Oliver Street and the East River. Special control boards are being installed in both stations to take care of these valves. There is also a control board in each vault at the manhole for rare cases of emergency.

The electrically operated valve at Stone and Whitehall Street is the third valve of the duplex system, the other two being in Houston Street east of the Bowery and at New Chambers Street and New Bowery. The new one will be operated by a three-horsepower motor in the vault controlled as are the other two valves on the duplex system from the Oliver Street station. The duplex system consists in reality of two interlaced but independent systems which connect only at three points, the connections being controlled by the valves electrically operated from the pumping station. A break on either system will immediately show itself on the Venturi chart or pressure gauges on the pumping station outlet to the system and the simultaneous closing of the three valves will isolate the crippled system in about one minute, the other system continuing in operation. Roughly speaking the duplex system covers the territory south of Houston Street all the way to the Battery and east of the Bowery, Park Row and Nassau Street.



Test Meter Removed from Case.

Light-Weight Portable Test Meter.

A New Light-Weight Test Meter.

A new alternating-current test meter has been placed on the market which will materially lighten the burden of the test man. The meter weighs but 7.75 pounds and has outside dimensions less than 6 inches square by 7.5 inches high when closed. The meter is contained in an antique-finished oak case provided with a leather strap for carrying.

The moving element is an aluminum disk mounted on a shaft of aluminum alloy. Attached to the shaft is a large hand which indicates on a large dial in hundredth parts of a revolution. Two smaller pointers with corresponding dials are located on the large dial. One of these small pointers makes one revolution for every ten of the larger pointer while the other makes one revolution for every 100 of the large one.

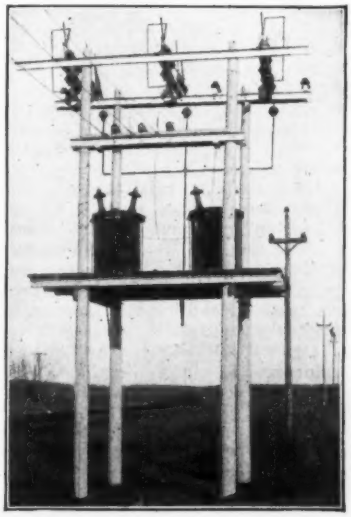
The current coils are of one and ten amperes capacity, making this meter suitable for testing meters of capacities up to 15 amperes on both heavy and light loads. In series with the one-ampere winding there is a fuse of small current-carrying capacity protecting this winding from being burned out by accidental overload or short-circuit.

The meter is provided with micrometer for light-load adjustments. By the use of this meter 90 per cent of the alternating-current meters of the average central station, including polyphase meters, may be tested quickly, conveniently, and accurately at the point of installation.

The test meter described above is known as the IB-5 and is manufactured by the General Electric Company, Schenectady, N. Y.

Outdoor High-Tension Substations.—A Correction.

Under the title "Standard Outdoor High-Tension Substations," an article was published in the January 24 issue of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN describing and illustrating the standard 22,000-volt, three-phase substation manufactured by the Delta-Star Electric Company, Chicago, Ill. An incorrect illustration was used, the station described in the article being shown in the accompanying illustration. The illustration shown in the previous article was that of a station which was designed by Sargent & Lundy, of Chicago, and is one of several operating on the lines of the Central Illinois Public Service Company. That substation was described in a paper by H. W. Young, president of the Delta-Star Electric Company, read before the Western Society of Engineers.



Standard 22,000-Volt Outdoor Substation.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

DARTMOUTH, MASS.—This town is considering the installing of electric street lighting. W.

PALM BEACH, FLA.—Charles Kennedy will erect an electric plant and ice factory.

CALLAO, MO.—At a special election the proposition for a municipal lighting plant carried.

CAVE CITY, KY.—S. B. Davis states a company is being organized to install electric light plant.

PALM BEACH, FLA.—Atlantic Fish Company will build an electric light, cold storage and ice plant here.

ELKPOINT, S. D.—Work will be commenced at once on a $25,000 municipal electric light plant. Address the city clerk.

MICANOPY, FLA.—$10,000 will be expended for the construction of an electric light plant. Address the mayor for particulars.

ARCADIA, CAL.—The city clerk has called for bids for a 50-year electric franchise in this town, bids to be opened on April 4.

LANGDON, MINN.—The citizens have subscribed $7,500 for the proposed electric line to be established here. Address the city clerk.

SCOTLAND NECK, N. C.—$10,000 will be expended improving the electric light plant. Address A. L. Purrington for information.

BARTOW, FLA.—$20,500 of municipal bonds for improving the electric light plant were voted. Address Robert C. Halton, mayor, for information.

MASON, OHIO.—The Village Council has retained Seidl and Hausman, of Cleveland, to prepare plans for a municipal electric lighting system here.

ROWLAND, N. C.—The town will construct an electric light plant. $30,000 in bonds will be issued. Address J. McR. Bracy, mayor, for information.

THATCHER, ARIZ.—The Gila Valley Electric, Gas & Water Company has applied for a franchise to operate an electric lighting system in this town.

CEDAR FALLS, IOWA.—March 20 bids will be received by the County Board for an electric plant for the infirmary. Address J. J. Rainbow, architect.

ST. JOHN, KANS.—An agitation is in progress here for the installation of a municipal ice and electric light plant. Address the city clerk for particulars.

LOUISVILLE, KY.—The city is planning an automobile repair shop for which motor equipment may be needed. The Board of Works may be addressed in regard to the matter. G.

MOUNT HOLLY, N. J.—The Asylum Committee of the Board of Freeholders will immediately install an electric lighting plant at the institution named. A.

LOUISVILLE, KY.—The Louisville Pillow Company is to purchase an electric freight elevator, load capacity 3,000 pounds. M. P. Kelley is general manager. G.

RAHWAY, N. J.—The Common Council is considering the installation of a municipal electric lighting plant. Investigations of cost, etc., will be made. A.

MILFORD, N. J.—The Borough officials will install a municipal electric lighting plant, bonds for which were recently approved by a vote of the citizens. A.

SHELBYVILLE, KY. — The Kentucky Utilities Company is planning to build a dam on Clear Creek for the purpose of insuring an additional water supply. G.

CHATTANOOGA, TENN. — The Chattanooga Plow Company will need 300 horsepower in motors, having decided to substitute electric current for steam. G.

EVANSVILLE, IND. — The Board of Public Works is planning a rearrangement of the street lighting system, involving the location of new lamps. G.

MOREHEAD, KY.—The municipal electric light plant was recently burned, with a loss of $10,000. The mayor and other officials are arranging to rebuild at once. G.

WAYNESBORO, MISS.—The Electric Light Company has been incorporated with a capital stock of $30,000 by C. C. Green, O. R. Green and J. A. Leggett.

MORRISTOWN, TENN.—The Mims Goodson Company will purchase electric elevators for installation in a six-story mercantile building which it will erect. G.

HUNTINGTON, ARK.—The Huntington Electric Light & Power Company has been organized here with a capital stock of $8,000. John Degen is president.

BOWLING GREEN, KY. — The Board of Public Works is getting estimates on the cost of installing additional equipment in its city electric light plant. G.

DUCKTOWN, TENN.—The Tennessee Copper Company is reported to be in the market for electrical power equipment for the operation of mining machinery. G.

KNOXVILLE, TENN.—The Knoxville Railway & Light Company is making preparations to begin work on the construction of an underground conduit system. G.

ARKANSAS CITY, KANS.—Burns and McDonald, of Kansas City, have prepared plans for the proposed electric plant. Address the city clerk for information.

ST. CHARLES, VA.—The Electric Transmission Company, plans to triple the capacity of its electric plant and transmission system, increasing to 35,000 horsepower.

LOUISVILLE, KY. — The Merchants' Ice & Cold Storage Company is planning to install two electric freight elevators. Address N. A. Hardin, manager. G.

UPPER SANDUSKY, O.—An ordinance has been passed by the City Council authorizing a bond issue of $25,000 for the erection of a municipal electric light plant. J.

HAZELWOOD, N. C.—The town will construct an electric light and water system. $15,000 in bonds will be issued. Address W. H. Cole, chairman, Finance Committee.

RHEA SPRINGS, TENN. — The Central Tennessee Development Company is reported to be considering the construction of a hydroelectric plant on the Tennessee River. G.

LOUDONVILLE, O.—Extensive repairs to the municipal electric lighting plant, involving the purchase of considerable new machinery, has been authorized by the local council. J.

ARKADELPHIA, ARK.—The Arkansas Power Company will expend $15,000 on improving the electric light plant. Address H. C. Couch, 308 State National Bank, president.

BENSON, S. C.—A charter was granted to the Benson Electric Light Company, capitalized at $50,000. The incorporators include W. S. Murchison, A. B. Hudson and others.

GORDONVILLE, TENN. — The Gordonville Electric Light & Power Company plans to construct a plant with a capacity of 50 kilowatts. Robert Harvey is in charge of plans. G.

RIVERSIDE, CAL.—The City Council is again reviving the proposal of installing an ornamental lighting system on Seventh Street between Rubidoux Mountain and the Santa Fe Depot.

VICTORIA, VA.—The town of Victoria is advertising a franchise for electric lights and also one for telephones. Address H. T. Faison, town clerk, in regard to these projects.

PAYETTE, IDAHO. — Pence & Went are preparing plans for a large electrical pumping station, to be built 2.5 miles southeast of the city, to be used in irrigating orchard lands. O.

LOS ANGELES, CAL.—The Pacific Light & Power Corporation will build a new substation at Vernon to cost about $175,000, and replace its former plant recently destroyed by fire. A.

HECTOR, MINN. — The Renville County Electric Company has been granted a franchise for electric lights and power system here, and a transmission line will be built from Bird Island.

EMERY, S. D.—A movement has been inaugurated to have Emery lighted by electric lights and it is expected

arrangements will be made to install a lighting system. Address the city clerk.

BELLINGHAM, WASH.—Mayor J. P. De Mattos, in a special message to the City Council, recommended the bonding of this city for $400,000, to be used in building a municipal lighting plant. O.

RIALTO, CAL.—Bids will be received by the Board of Trustees until April 7 for a 59-year franchise for the transmission of electricity in this town, as applied for by the Rialto Light, Power & Water Co.

COLTON, N. Y.—An order has been issued by the Second District Public Service Commission, approving the construction and operation by Bernard H. Snell and Sara M. Snell of a power plant at Higley Falls in this town by June 1, 1914.

GREENVILLE, O.—Operating seven plants in as many different towns, the Greenville Electric Lighting Company has been authorized by its stockholders to increase its capital stock by $40,000, with which to make extensions to present lines. J.

CLEVELAND, O.—H. Whitford Jones, electrical engineer, has plans nearly ready for the new lighting system for the city of Mansfield. He proposes to specify nitrogen tungsten lamps. Complete plans will be ready early in March. R.

LINN CREEK, MO.—Central Missouri Power Company will organize to construct a hydroelectric plant to develop 3,000 horsepower at this place. There are plans to construct a dam, power house, transmission line, etc., at an expenditure of $250,000.

VANCOUVER, WASH.—The Clarke County Power Company is contemplating entering the electric light and power field in Clarke County, and is trying to interest the Commercial Club here in the proposition. J. H. Cunningham is chief engineer. O.

HEBER SPRINGS, ARK.—Arkansas Hydroelectric Company will expend $2,000,000 for a hydroelectric plant to develop 10,000 horsepower; will construct three dams of reinforced concrete, 100-mile transmission line to cost $75,000, and other facilities.

HELENA, MONT.—Citizens of the West Side recently petitioned the City Council for an ornamental lighting system similar to the one now in use on the East Side. Mayor Purcell is in favor of granting the petition, and the Council will take immediate action. O.

AKRON, O.—O. C. Barber, who hopes to receive from the city of Canton a franchise for an electric power plant at Howenstein, and a franchise in the city of Canton, is considering the extension of his service to cover Alliance, New Philadelphia and Massillon. R.

TACOMA, WASH.—The City Council has adopted the report of Commissioner Nick Lawson in regard to the matter of expending $1,896 in extending a transmission line to the city limits, and to furnish power for use at the county gravel pit near Lakeview. O.

ARMSTRONG SPRINGS, ARK.—D. E. Harrison, manager of the Armstrong Springs Hotel, is planning the installation of an isolated electric plant at once, and would like to receive catalogs and prices on 10-horsepower gas engines and six-kilowatt direct-current dynamos.

NASHVILLE, TENN.—The City Commissioners are reported to have approved plans for doubling the output of the municipal electric light plant so as to furnish electricity for commercial purposes. It is contemplated installing a turbogenerating unit costing $35,000.

COLUMBUS, O.—An improvement which has just been authorized by the City Council carries with it the placing of electric light wires, and all other wires except trolley, under ground. This is the first move in a general campaign for removing overhead wires from all down-town streets. J.

WINFRED, S. D.—The City Council of this city has opened negotiations with an electric light company at Howard to extend its wires to this place so Winfred can be lighted in a modern manner. If suitable arrangements can be made the necessary franchise will be granted the Howard Company.

ST. CHARLES, VA.—The Electric Transmission Company is reported to have plans for increasing the capacity of its plant to 35,000 horsepower, to enable it to supply current to a large number of coal mines. The Insull interests of Chicago, it is said, have purchased control of the company. G.

SPENCER, S. D.—Steps have been taken here to organize a stock company for the purpose of installing an electric light system. In the event that sufficient stock is not subscribed, it is probable a franchise for the lighting system will be granted to an outside company. Address John Krause for further particulars.

DAYTON, TENN. — The Dayton Light & Power Company has been formed with $100,000 capital stock by Chattanooga interests and will get power from the transmission line of the Tennessee Power Company. The Dayton company will build its own transmission line to the main line of the Tennessee Power Company. G.

KALAMA, WASH.—The Washington-Oregon Corporation, which owns and operates a network of power lines in Southwest Washington, extending from Tenino to Kalama, is considering the proposition of erecting a new $250,000 power house on the Kalama River, to replace the one recently destroyed by fire, which, it is said, was valued at $30,000. O.

WHITE SULPHUR SPRINGS, MONT.—Civic improvements to cost approximately $100,000, which include the installation of an ornamental lighting system, will be made in this city during the year. Work is to begin early in the Spring. The light system will be installed under the supervision of Gerharz-Jaqueth Engineering Company, of Billings, Mont. O.

HARTWELL, GA.—Franklin Light & Power Company proposes to construct two steam plants here to develop 5,000 horsepower; hydroelectric developments to follow. Forty miles of transmission lines to cost $50,000 connecting Hartwell, Lavonia, Conan, Bowersville and Royston, Ga., will be constructed. The total cost of the plants is estimated at $100,000.

PORTLAND, ME.—The Cumberland County Power & Light Company has acquired right of way for a pole and tower transmission line to connect its present 38,000-volt line at Dunstan with the steam power plant of the York Light & Heat Company in Biddeford. The latter company has recently been acquired by the Cumberland Company. The cost of the line will be about $45,000. W.

YOUNGSTOWN, O.—The Consolidated Company will place all overhead wires in Federal Street underground. This work will be of course very expensive owing to the tons of costly lead-covered high-voltage cable which it will be necessary to purchase to do the work, which is estimated to cost about $60,000. Address the general manager of the Consolidated Company in regard to this work.

NORTH YAKIMA, WASH. — The Board of County Commissioners, Yakima County, have granted the franchise asked by the Pacific Power & Light Company for light and power lines over and along Valleyview Avenue, County Road No. 5, Hillcrest Way, and Grand View and Orchard Avenues, in the district adjacent to North Yakima on the west. The line will be nearly three miles in length.

TAPPAHANNOCK, VA. — The Tidewater F. P. Lighting Company, incorporated, has been organized in Tappahannock, and capitalized at $5,000. The object of the company is to sell and install all kinds of lighting and heating equipments. H. C. DeShields, A. A. Cralle, J. C. Phillips and George W. Daingerfield are the incorporators. Application has been made for a charter, and the company will begin operations in a very short time.

RUSHVILLE, ILL.—As a result of the heavy tolls levied by the local public service corporation, amounting to $6,000 per annum, members of the City Council and Mayor Glass have been considering for several months the advisability of establishing a municipal electric plant to be used for street lighting and for pumping water from McElho for the city water system, and a committee consisting of Aldermen Keeling, Hodgson and Purcell, has been appointed to investigate the proposition.

FREEPORT, TEX.—Freeport is soon to have a new electric lighting and power system suited to meet the needs of this growing sea-port. In connection with the super-heated water and power plant now being installed at the Freeport Sulphur Company mines, at Bryan Heights, a new central electric power plant has been recently included in the plans, and will be installed in the next few months. This plant, it is announced, will supply electric light and power to Freeport through transmission lines.

SACRAMENTO, CAL.—Through an application to the State Conservation Commission, and by the statement of C. H. McKendree of Lakeview, Ore., a power project is revealed intended to furnish 100,000 horsepower by harnessing the waters of Fall River in Shasta County. Incidentally the Commission will be called upon to decide a novel point involving the disposition of power generated on a California waterway in the neighboring states of Oregon and Nevada. The application calls for permission to divert a flow of 1,500 cubic feet of water per second, capable of generating 48,000 horsepower.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

MUSCATINE, IOWA.—The Iowa Telephone Company will improve its local system at a cost of $25,000. C.

WESTBORO, WIS. — Westboro Telephone Company has been incorporated with a capitalization of $2,500 by J. W. Kaye and others.

THOMASVILLE, GA.—The Consolidated Telephone & Telegraph Company has been incorporated with a capitalization of $250,000.

DEADWOOD, S. D.—Western Union Telegraph Company will rebuild its line in the Black Hills and install new equipment, costing $275,000. C.

MONTESANO, WASH. — The Montesano Telephone Company, William Shore manager, will install a modern telephone system in this city, it is stated. O.

BOSCOBEL, WIS.—Pleasant Valley Farm Telephone Company has been incorporated with a capital of $500 by A. E. Anderson, J. V. Staskal and G. K. Roen.

OUTLOOK, WASH.—Outlook Telephone Company has been incorporated with a capital of $5,710 by H. C. Davis, W. F. Nass, A. C. Turner and William Barnes.

MADISON, S. D.—The Dakota Central Telephone Company plans to install a new system and remove all poles to the alleys. George Pheifer is manager. C.

DUNLAP, TENN.—A company has been organized to construct a telephone system from Dunlap to Whitewell. J. J. Lasater is president and D. M. Harris, secretary.

MEADOWDALE, WASH. — Sound Telephone Company has been incorporated with a capital stock of $5,000 by W. P. Cleveland, Louis Andrew and Joseph R. Cleveland.

EUREKA, MONT. — The directors of the Eureka Mutual Telephone Company are considering building an extension of their lines up St. Clair Creek and to Gateway.

SEQUATCHIE, Tenn. — The Sequatchie Valley Mutual Telephone Company has been incorporated with a capital stock of $3,000 by Landy Phelps, L. J. Lewis and others.

SACRAMENTO, CAL.—Charles A. Loraine has been granted a certificate of public necessity and convenience to exercise a telephone franchise granted by the Supervisors of El Dorado County.

MUSKEGON, MICH. — Providing the State Railway Commission approves of its action, the United Home Telephone Company will issue bonds or stock for $150,000 to build an entire new system in Muskegon.

NORMAN, OKLA.—The Norman Telephone Company will construct a central plant and install a central-energy system and place heavier cables underground. Address Dwight and Bozell, of Norman, for desired information.

CHESTERVILLE, N. Y.—The Chesterville Local Telephone Company, Incorporated, has been granted articles of incorporation with a capitalization of $154. The incorporators are Elmer J. Hunt, Dormansville; Theodore De La Verone and Edward King, of Westerlo.

ATLANTA, GA.—Southern Bell Tel-Telephone & Telegraph Company has issued $5,000,000 bonds for improvements to its system in territory embracing Georgia, Florida, North and South Carolina, Kentucky, Tennessee, Mississippi, Louisiana and portions of Illinois and Indiana.

POCATELLO, IDAHO.—The Mountain States Telephone & Telegraph Company has prepared plans and will immediately begin construction of a new telephone exchange in this city. The plans also entail the installation of new cables and conduit, and in all about $80,000 will be spent in this city. O.

HILLSBORO, ORE.—The Hillsboro Telephone Company, has sold a controlling interest in the local telephone system to Charles E. Wells, of Kingsville, Tex., for $20,000. Mr. Wells took over the management of the system March 1, and announces that he will make several large improvements. O.

OLYMPIA, WASH.—The Chamber Lake Telephone line recently petitioned the County Commissioners for a franchise to construct and maintain a telephone line along certain county roads beginning at the intersection of the Boulevard and Pacific Highway, and extending south along the J. A. Kirby, Herman and other roads. O.

DALLAS, TEX.—The Commissioners' Court of Dallas County has granted a franchise to the Texas Power & Light Company for the construction of a telephone line from Dallas to Eagle Ford and Cement City, to be used in connection with the electric power supply line being installed by the company into Cement City. D.

OLYMPIA, WASH.—The Lacey-Chambers Prairie Mutual Telephone Company, through its president, John W. Mayes, recently filed a petition with the County Commissioners of Thurston County for a franchise to build and operate a telephone system over certain portions of the Pacific Highway and the Yelm and Rainier Roads. O.

GAGE, MONT.—The North Side Telephone Company, composed of ranchers in this vicinity, has recently been organized for the purpose of building 20 miles of telephone lines, which will connect up this section with Gage. Work will commence, according to all reports, as soon as the weather will permit. Address President James Batschelet, here.

OLYMPIA, WASH. — Representatives of the Peninsula, Mud Bay, Snider Prairie and West Side Telephone Companies, recently organized and consolidated into one company, following which an application was made for a franchise authorizing the placing of poles and stringing of wires along certain county roads. Charles E. Starr is Chairman of the Board of Directors. O.

BOZEMAN, MONT.—Articles of incorporation have just been filed for the Farmers' Home Telephone Company, a corporation formed for the purpose of constructing, purchasing, leasing, operating and maintaining telephone and telegraph lines, and conducting telephone exchanges in certain parts of Gallatin, Broadwater and Jefferson Counties. G. C. Watson, Three Forks, is president. O.

ELECTRIC RAILWAYS.

(Special Correspondence.)

MIDDLEBORO, KY.—The city is advertising the sale of a franchise for the operation of a street railway April 30. Address Mayor Manring for details. G.

PORTSMOUTH, O.—Portsmouth Street Railway Company wishes to issue $500,000 in bonds for a street-car line from Sciotoville to Ironton. It awaits the decision of the State Public Utilities Commission. R.

LONG PRAIRIE, MINN.—R. H. Battey, of Detroit, and F. D. Brandenberg, of Thief River Falls, are endeavoring to interest local business men in a company to build an electric line from Thief River Falls east and south.

CHARDON, O.—Right of way for the proposed Chardon-Jefferson electric line from Chardon to Hambden has been forwarded to the company's officers. The matter of financing has been taken up with the state utilities commission. R.

LOS ANGELES, Cal.—The Los Angeles Railway Company has made application to the State Railroad Commission for the privilege of issuing bonds to the amount of $23,500,000, the proceeds to be used in extending and improving the line of the Los Angeles company. T.

LONG PRAIRIE, MINN.—R. H. Battey, of Detroit, and F. D. Brandenberg, of Thief River Falls, are endeavoring to interest local business men in a company that proposes to build an electric line from Thief River Falls east and south through this part of the state. C.

SAN ANTONIO, TEX.—The Alamo Engineering & Construction Company has been organized here with a capital stock of $20,000. It is stated that the company will build the proposed interurban line between Waco and Austin. W. J. Armstrong, of San Antonio, is named as the principal incorporator. D.

SAN FRANCISCO, Cal.—The Board of Public Works has called for bids to be opened on May 4 for building the Chestnut Street branch of the Municipal Street Railway system from Van Ness Avenue along the Exposition Grounds. This will be the first portion of the extension to be built under the recent bond issue.

AKRON, O.—Out of the $2,000,000 additional preferred stock authorized by the Northern Ohio Traction & Light Company, extensive improvements will be made in Akron during the spring and summer. The sum of $150,000 has been set aside for the purpose of double-track work on the company's Akron, Barberton & Cleveland line. J.

PITTSBURGH, PA.—The Cleveland-Pennsylvania Interurban Railway Company has been incorporated. The company proposes to build and operate a line between Cleveland and Sharon and eventually expects to extend the line to Pittsburgh by way of Newcastle. The incorporators are Harry P. Smith, Elijah Ashley and others, of Pittsburgh.

LOUISVILLE, KY.—W. H. Netherland, of Louisville, is interested in a company being organized to build an electric line running through Muhlenberg County, from Central City to Greenville and Central City to Drakes-

boro, to be operated in conjunction with a large hydroelectric power station in Green River, a few miles from Mount Olive. The primary object of the power station is to sell current for light and power to numerous coal mining concerns in western Kentucky.

SAN FRANCISCO, CAL.—The Ocean Shore Railroad Company has officially applied to the Railroad Commission for authority to issue $200,000 in bonds for the purpose of electrifying the road from San Francisco to Half Moon Bay. According to present plans the electrification will be by means of a groove trolley, and estimates include substations, telephone lines and other equipment. Provision is made in the application for new motor cars to cost $55,000 and for an electric engine to cost $24,000.

NEW INCORPORATIONS.

DETROIT, MICH.—Victor Electric Supply Company has been incorporated with a capitalization of $15,000.

MANITOWOC, WIS.—E. Stupecky & Company has been incorporated by Edward Stupecky, Leonard Zielsdorf and Edward Warren.

DALLAS, TEX.—Carroll Electric Company has been incorporated with a capital stock of $5,000 by E. A. Corley, William M. Jones and William C. Carroll.

ELDORADO, WIS. — Wisconsin Light, Power & Milling Company has been incorporated with a capital stock of $10,000 by O. A. Huelsman, A. H. Genrich and L. F. Lurvey.

BOSTON, MASS.—The Cole Railway Equipment Company has been incorporated with a capital of $250,000. Charles W. Potter, Harry A. English and Elizabeth F. Uniac are the incorporators. W.

LOS ANGELES, CAL.—The Independent Electrical Supply Company has been incorporated with a capital stock of $25,000. The incorporators are Hyman Schwartz, I. E. Irvine, E. Irvine and James Irvine. T.

AUGUSTA, ME.—The Continental Engineering Company has been incorporated, capitalized at $1,000,000. The incorporators are Ernest L. McLean, Augusta; E. M. Leavitt, Winthrop; R. A. Kittredge, Hallowell. W.

MANHATTAN, N. Y.—Bateman & Miller Electric Company has been incorporated with a capital stock of $5,000 by Charles D. Bateman, John Miller, of New York City, and Charles F. Hulseman, of Brooklyn.

McINTOSH, S. D.—The McIntosh Electric Company has been incorporated with a capital stock of $5,000. The company will build an electrical plant. The incorporators are T. W. Luke, Harry Luke and W. D. Snyder.

BANGOR, ME.—The Eastern Maine Power & Development Company has been incorporated with a capital of $200,000. The incorporators are Nelson H. Hydorn, Oscar A. Fickett and Terence B. Towle, all of Bangor. W.

DULUTH, MINN.—Articles of incorporation have been granted to the Western Mesaba Electric Company to engage in business in this city. The capital stock of the company is $100,000 and the incorporators are Frank McCormack, M. J. McCormack and James A. Hanks.

DOVER, DEL.—Articles of incorporation have been filed for the Dwyer Wireless Telephone Company, New York-San Francisco, the business being to conduct wireless telegraphy, telephony, aerophony and to construct buildings, stations, etc., for that purpose. The capital stock is $10,000,000. The incorporators are Max Oschler, Samuel H. Loveless, Sydney M. Oschler, and Antonio C. Montgomery, all of New York City; Harry P. Dwyer, George Hough Perry, William Henry Schooler and Lloyd Michels, all of San Francisco.

FOREIGN TRADE OPPORTUNITIES.

(Where addresses are omitted they may be obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C., and at the branch offices of the Bureau, 315 Customhouse, New York, N. Y., 629 Federal Building, Chicago, Ill., and Association of Commerce Building, New Orleans, La. Apply for addresses in letter form, giving file number.)

No. 12,532. ELECTRIC CRANES.—The American consul at Madrid, Spain, reports that proposals are requested for supplying and installing in the port of Gijon Musel four electric cranes with the corresponding electric line, the estimated cost of which is about $53,000; and the construction of the railway line necessary for these cranes, the estimated cost of which is $7,500. Proposals must be submitted through a resident agent to the Secretaria de la Junta del Puerto de Gijon Musel, Gijon Musel, Province of Oviedo, Spain, before March 27. A list of persons in a position to bid on this contract may be obtained from the Bureau of Foreign and Domestic Commerce.

No. 12,533. ELECTRIC HOUSEHOLD APPLIANCES.—An American consul in Canada reports that a city in his district is about to have a daytime electric-current service. There will be a moderate demand for electric household accessories, flatirons, etc. Catalogs should be sent immediately to a number of firms whose names were given in the report, as the new service is to be inaugurated in May.

No. 12,592. ELECTROMAGNET FOR PORT WORK.—A large electromagnet for discharging scrap iron and other metal material from steamships in a certain European port is to be purchased by the authorities. American firms in a position to supply the same should communicate with the Harbor Board, in Italian, stating prices, terms, specifications, etc. American companies wishing to treat with a local firm in the matter and desiring to sell through this firm may address a concern named by an American consular officer.

No. 12,596. TUNGSTEN LAMPS.—A business firm in Canada, which furnishes bank references, informs an American consular officer that it desires to be put in touch with American manufacturers of incandescent lamps, with a view to securing the exclusive agency for British Columbia.

No. 12,606. DYNAMOS AND ELECTRIC SUPPLIES.—A report from an American consular officer in India states that a local firm desires to be placed in communication with American manufacturers of dynamos and electric stores. The firm desires to import direct or to act as agents in India for American manufacturers. Catalogs, price lists, and discounts are desired. Correspondence may be in English.

PROPOSALS.

TRANSFORMERS, ETC.—Sealed bids will be received by J. N. Cowdery, director of public service. Niles, O., until March 9, for furnishing transformers, incandescent lamps, and meters for the electric light plant. R.

CABLE.—Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until April 14 for furnishing considerable electrical cable, as per Schedule 6433, for delivery at the Navy Yard, Pearl Harbor.

ELECTRICAL APPLIANCES. — Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until March 17 for furnishing miscellaneous galvanometers, etc., as per Schedule 6449, for delivery at the Navy Yard, Annapolis, Md.; four 300-kilowatt turbogenerating sets and spare parts, as per Schedule 6432, for delivery at the Navy Yard, Brooklyn, N. Y.

RUBBER-INSULATED CABLE.—Sealed proposals will be received at the Engineer Depot, U. S. Army, Washington Barracks, D. C., until March 17 for furnishing armored duplex rubber-insulated lead-sheathed cable as follows: Item 1, 19,500 feet 81 mils.; item 2, 4,500 feet 26,300 cir. mils.; item 3, 3,020 feet 106,000 cir. mils.; unarmored duplex rubber-insulated lead-sheathed cable; item 4, 5,200 feet 81 mils. Further information upon application to Joseph E. Kuhn, lt., col., corps engrs., U. S. Army.

ADDITION TO ELECTRIC LIGHTING PLANT.—Sealed proposals will be received by the Borough Council of South River, N. J., on March 9 for an addition to the present borough electric lighting plant, including the installation of a gas producer, gas engine, generator and switchboard, in accordance with drawings and specifications prepared by C. S. Partridge, superintendent of the Board of Public Works, and now on file in his office. All bids must be accompanied by a certified check on a New Jersey national bank, payable to the order of George Allgair, borough collector, without any additional endorsement whatever.

ELECTRICAL SUPPLIES.—Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until March 17 for furnishing restranding and reinsulating cables, to be delivered at the Navy Yard, Boston, Mass.; 50,000 feet of incandescent lamp cord, and 1,110 polished-brass key sockets, fiber lined, one-eighth-inch pipe, to be delivered at the Navy Yard, Brooklyn, N. Y., all as per Schedule 6471; 1,000 five-ampere receptacle plugs, 300 double and snap-switch receptacles, and miscellaneous electrical supplies, for delivery at the Navy Yard, Washington, D. C., as per Schedule 6473; two telephone ringing dynamotors, two 50-watt talking motor generators, one telephone switchboard, type C-54, and miscellaneous telephones, for delivery at the Navy Yard, Camden, N. J., as per Schedule 6477. The Bureau will also receive proposals until March 24 for 3,000 feet of rubber-insulated rattail wire for aerials, for delivery at the Navy Yard, Brooklyn, N. Y., as per Schedule 6489.

FINANCIAL NOTES.

The Pacific Gas & Electric Company has decided to pay off on March 25 all of its outstanding six-per-cent gold notes dated July 1, 1913. The notes will be redeemed at 100.5 and accrued interest, and after that date interest will cease to accrue.

The recent increase in the authorized capital of the Northern Electric Company to $10,000,000 is explained by the statement that the company is absorbing the Imperial Wire & Cable Company, the other big subsidiary of the Bell Telephone Company of Canada. The president of the merged companies will be E. F. Sise and the vice-president Paul F. Sise.

The Commonwealth Power, Railway & Light Company has sold to Hodenpyl, Hardy & Company, $1,500,000 convertible six-per-cent five-year bonds, dated May 1, 1913. The bonds are part of an authorized issue of $10,000,000, which, with present offering, are now all outstanding. The bonds have been offered at a semi-private sale at 99 and nearly all of them have been sold.

For the week ended February 14, all electric properties operated by H. M. Byllesby & Company showed a net gain in connected load of 230 customers with 293 kilowatts of lighting and 138 horsepower in motors. New business under contract, but not connected, included 713 customers with 466 kilowatts of lighting and 572 horsepower in motors. The output of the properties for the week was 6,910,055 kilowatt hours, an increase of eight per cent over the corresponding week of 1913.

Empire District Electric, which has sold $350,000 out of an authorized issue of $500,000 of one-year six-per-cent coupon notes to New York bankers; is a subsidiary of the Cities Service Company and operates in southwestern Missouri and southeastern Kansas. The notes are secured by the pledge of $600,000 of the first-mortgage bonds of the company, and in case the remaining $150,000 of notes are issued a proportionate amount of bonds will be deposited as collateral.

The Arkansas Hydroelectric Company, of Heber Springs, Ark., is planning to invest $2,000,000 to construct a hydroelectric plant developing 10,000 horsepower, on the Little River, near Heber Springs. There will be three dams, one principal power dam, 600 feet long by 90 feet high; two reservoir dams, 1,400 and 800 feet long, respectively, and each 90 feet high. The electrical transmission system will cost $80,000 to install. The electric equipment is for a four-unit installation totaling 10,000 horsepower and water-wheel equipment for four turbines under a 90-foot head, with 70,000 cubic feet of water per minute.

Lee, Higginson & Company and Drexel & Company have bought $5,800,000 Portland Railway, Light & Power Company first and refunding mortgage five-per-cent bonds due 1942. The bonds were sold by the company to pay for completed improvements. They are part of a total authorized issue of $75,000,000, of which $21,800,000 is now outstanding, and $18,000,000 is reserved for retiring underlying bonds. The remainder can be issued for not exceeding 80 per cent of cash costs of additions and improvements under restrictions of the mortgage. The issue has a cumulative sinking fund of one per cent annually, 1915 to 1926 inclusive, and 1.5 per cent annually thereafter, figured on total amount issued.

Dividends.

Brooklyn Rapid Transit Company; a quarterly dividend of 1.5 per cent, payable April 1 to stock of record March 9.

Chicago Elevated Railway; regular quarterly dividend of $1.50 on participation referred certificates, payable March 2 to stock of record February 26.

Chicago Telephone Company; the regular quarterly dividend of two per cent, payable March 31, to stock of record March 30.

Eastern Power & Light Corporation; the regular quarterly dividend of 1.5 per cent on preferred stock, payable March 15 to stock of record Feb. 28.

Monongahela Valley Traction Company, 1.5 per cent on common, payable March 2 to stock of record February 26.

Montana Power Company; regular quarterly of 1.75 per cent on preferred and 0.5 per cent on common, payable April 1 to stock of record March 16.

New York Edison Company; quarterly of 1.5 per cent, payable March 14.

Northern Ohio Traction & Light Company; quarterly of 1.25 per cent on common, payable March 15 to stock of record February 28.

United Gas & Electric Company; a semi-annual first-preferred dividend of three per cent; payable April 1 to stock of record March 14.

Reports of Earnings.

KEYSTONE TELEPHONE COMPANY.

	1914	1913
January gross	$ 107,479	$ 104,027
Net	53,200	49,615
Surplus	26,467	24,040

MOUNTAIN STATES TELEPHONE.

The Mountain States Telephone Company's report for the year ended December 31, 1913, compares as follows:

	1913	1912
Gross	$ 7,530,211	$ 6,844,576
Net	2,847,574	2,513,371

CUMBERLAND COUNTY POWER & LIGHT.

	1913	1912
December gross	$ 205,547	$ 175,134
Net after taxes	89,484	73,122
Surplus after charges	25,908	16,612
12 months' gross	2,354,797	2,128,388
Net after taxes	1,041,924	927,054
Surplus after charges	327,651	282,280
Balance after preferred dividends	*193,651	199,780

*Equivalent to 7.2 per cent on common stock.

BANGOR RAILWAY & ELECTRIC.

	1913	1912
December gross	$ 65,645	$ 60,334
Net after taxes	34,919	31,516
Surplus after charges	17,565	14,175
12 months' gross	764,085	710,027
Net after taxes	417,573	389,185
Surplus after charges	209,989	189,528
Balance after preferred dividends	*104,989	84,528

*Equivalent to 5.2 per cent on common stock.

CONSUMERS POWER OF MICHIGAN.

	1913	1912
December gross	$ 325,028	$ 284,111
Net after taxes	147,742	112,888
Surplus after charges	77,782	64,284
12 months' gross	3,155,214	2,774,551
Net after taxes	1,486,477	1,266,651
Surplus after charges	710,726	651,002
Balance after preferred dividends	392,226	381,002

BELL-TELEPHONE OF PENNSYLVANIA.

The Bell Telephone Company of Pennsylvania's report for the year ended December 31, 1913, compares as follows:

	1913	1912
Gross	$18,934,912	$17,803,375
Net	4,859,730	4,715,681
Surplus after interest and dividend	1,238,416	993,075

CITIES SERVICE COMPANY.

	1914	1913
January gross	$ 414,759	$ 169,989
Net after expense	411,173	164,270
Balance after interest	382,006	164,270
Balance after preferred dividends	245,174	100,804
Surplus after common dividends	166,646	67,277
12 months gross	2,417,180	1,237,464
Net after expense	2,333,965	1,165,102
Balance after interest	2,181,737	1,165,102
Balance after preferred dividends	*1,199,593	543,042
Surplus after common dividends	688,165	308,612

*Equivalent to 10.92 per cent on common stock.

COMMONWEALTH EDISON.

The report of the Commonwealth Edison Company for the year ended Dec. 31, 1913, compares as follows:

	1913	1912
Operating revenue	$16,838,743	$15,361,649
Operating expense and depreciation	9,504,427	8,855,572
Net operating revenue	7,334,316	6,506,077
Taxes and mun. company	1,353,915	1,127,195
Operating income	5,980,400	5,378,882
Other income	261,526	203,847
Total income	6,241,927	5,582,229
Interest on bonds	1,600,000	1,600,000
Depreciation reserve	544,000	544,000
Balance	*4,097,927	3,438,229
Dividends	2,816,864	2,516,783
Surplus	1,281,063	921,445

*Equal to 8.93 per cent on $45,838,936 capital stock against 10.4 per cent earned on $32,964,800 previous year.

NATIONAL CARBON COMPANY.

The National Carbon Company has issued its annual report for the year ended Dec. 31, 1913. The income account compares as follows:

	1913	1912
Net earnings	$1,476,621	$1,261,203
Preferred dividends	315,000	315,000
Balance	*1,161,621	946,203
Common dividends	330,000	330,000
Balance	$31,621	616,204
Depreciation, etc.	335,714	366,094
Surplus	495,907	250,110

*Equal to 21.12 per cent on $5,500,000 common stock, as compared with 17.2 per cent earned on same stock previous year.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Mar. 2	Feb. 23
American Tel. & Tel. (New York)	120½	121
Commonwealth Edison (Chicago)	136½	136
Edison Electric Illuminating (Boston)	260	260
Electric Storage Battery common (Philadelphia)	53¼	53¾
Electric Storage Battery preferred (Philadelphia)	53¼	53¾
General Electric (New York)	147	149¼
Kings County Electric (New York)	120¼	120¼
Manhattan Transit (New York)	1	1
Massachusetts Electric common (Boston)	11¼	11
Massachusetts Electric preferred (Boston)	61¾	62¼
National Carbon common (Chicago)	155	158
National Carbon preferred (Chicago)	115¼	117
New England Telephone (Boston)	138	139
Philadelphia Electric (Philadelphia)	26¾	26¾
Postal Telegraph and Cables common (New York)	86	86½
Postal Telegraph and Cables preferred (New York)	69¾	70
Western Union (New York)	53	64½
Westinghouse common (New York)	70¾	71¼
Westinghouse preferred (New York)	115	116

PERSONAL MENTION.

MR. JOSEPH S. MALLORY, fire marshal of the city of Philadelphia, addressed the Jovian Electrical League at its weekly luncheon at the Bingham Hotel on Thursday, March 5, on the subject of fire prevention.

MR. J. B. ANDERSON, who for five years has been superintendent of the Savannah (Ga.) Electric Company, has been transferred to Baton Rouge, La., where he will be superintendent of the lighting department of the Stone & Webster property there.

MR. FRANCIS E. DONOHOE, formerly of the American Electrical Works, New York City, resigned on February 1 to become associated with the National Conduit & Cable Company and the National Brass & Copper Tube Company, with headquarters at 41 Park Row, New York.

MR. W. A. CONVERSE, chemical director of the Dearborn Drug & Chemical Company, Chicago, delivered a lecture on "Ill Effects of Boiler Water and Their Causes" before the Newark, N. J., section of the National Association of Stationary Engineers on February 23.

MR. W. R. PATTON has been appointed manager of the Milwaukee office of the Wagner Electric Manufacturing Company recently opened at 731 Wells Building, Milwaukee, Wis. Mr. Patton has been connected with the Wagner Company for a number of years and has made a host of friends in the Middle West.

MR. L. L. STONE, president of the Pikesville (Ky.) Lighting Company, has been appointed manager of the electrical department of the Consolidation Coal Company. The company has large power plants at Jenkins and in other parts of Eastern Kentucky, and is constructing transmission lines for the purpose of supplying energy to coal mines and other communities.

MR. BERTRAM SMITH has been appointed assistant manager of the Edison Storage Battery Supply Company, of San Francisco. This company handles the Edison battery on the Pacific Coast. Mr. Smith started in the storage battery business in 1899 with the old National Battery Company, Buffalo, N. Y., and was secretary and treasurer for three years. Since the absorption of the National Battery Company by the United States Light & Heating Company, Mr. Smith has been manager of the latter company's battery department in Chicago.

MR. W. I. MIDDLETON, electrical engineer of the Simplex Wire & Cable Company, delivered an interesting lecture, illustrated by lantern slides, on the manufacture and testing of insulated wires and cables, at the Franklin Union, Boston, Mass., on February 26. He spoke also of the desirability of uniform specifications on insulation and the progress recently made along these lines by the Joint Rubber Insulation Committee. He pointed to the marked advance that manufacturers have already made in their testing departments, and spoke of the new voltmeter that his own company has developed for measuring peak voltages.

MR. E. W. CHAPIN, Harvard '13, has been appointed assistant in the department of electrical engineering, and MR. H. L. MANLEY, Massachusetts Tech. '11, and MR. A. I. PASHEK, Massachusetts Tech. '13, have been appointed special research assistants in the department of electrical engineering at the Massachusetts Institute of Technology. The two new research assistants are made necessary by increase in such work as the investigations which are under way for the R. H. Macy store, involving the examination of the entire delivery service, while Mr. Chapin will be engaged in matters related to the Vail library.

MR. W. F. BAUER has become assistant manager of the railway department of the Edison Storage Battery Company, at Orange, N. J. In the early days of electric car lighting Mr. Bauer was connected with the Pullman Company, of Chicago and Jersey City, and with the Wagner Palace Car Company. He was chief electrician of the Missouri-Pacific Railway at St. Louis from 1903 to 1905. Later on he became sales manager for the Electric Storage Battery Company at Chicago, and in 1907 he was appointed to a similar position with the National Battery Company. Later on he became manager of the United States Light & Heating Company's railway department at Chicago. He will make his headquarters at 2025 Michigan Avenue, and will have immediate supervision over the sales of the railway department for the west and southwest for the Edison company.

OBITUARY.

PROF. EDWIN J. HOUSTON, noted scientist, inventor, author and teacher, died at Philadelphia, Pa., on March 1, from heart disease. Mr. Houston was born at Alexandria, Va., on July 9, 1847. He was graduated from the Central High School in 1864 and later received the honorary degree of Ph. D. at Princeton. He was one of the inventors of the Thomson-Houston system of arc lighting. He was Emeritus Professor of Physics at Franklin Institute, Professor of Physics at the Medico-Chirurgical College, and a member of the American Institute of Mining Engineers and the American Philosophical Society. For many years Professor Houston occupied the chair of Natural Philosophy and Physical Geography in the Central High School of Philadelphia. He was an expert in electricity and was twice president of the American Institute of Electrical Engineers and was chief electrician at the World's Fair in Chicago. He was the author of several textbooks and editor of "The Electrical Dictionary."

Prof. E. J. Houston.

MR. WILLIAM E. PHELPS, for many years president of the Phelps Manufacturing Company, of Detroit, Mich., died at the home of his daughter, Mrs. Violet Lewis, in Seattle, Wash., on February 8. Mr. Phelps left Detroit last June in search of health. He was born at Elmwood, Ill., in 1833. During President Lincoln's administration he was Consul-General at St. Petersburg, and later served in the Illinois Legislature. He is survived by his widow, a son, J. Wiley Phelps, president of the Phelps Manufacturing Company, Detroit, and his daughter in Seattle.

DATES AHEAD.

Buffalo Electric Show. Elmwood Music Hall, Buffalo, N. Y., March 9-14. Secretary, Harry S. Hilliker, Electric Building, Buffalo, N. Y.

State Independent Telephone Association. Des Moines, Iowa, March 10-12. Secretary, Charles C. Deering, 309 Life Building, Des Moines, Ia.

Telegraphers' Mutual Benefit Association. New York, N. Y., March 11. Secretary, M. J. O'Leary, 195 Broadway, New York, N. Y.

American Railway Engineering Association. Annual convention, Chicago, Ill., March 17-20. Secretary, E. H. Pritch, 900 South Michigan Avenue, Chicago, Ill.

Minnesota Electrical Association. Annual convention, Minneapolis, Minn., March 18-20. Secretary, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn.

Society of Efficiency, New York, N. Y. April 4-11. Secretary, W. H. Tallis, 41 Park Row, New York City.

American Electrochemical Society. Twenty-fifth general meeting, New York, N. Y., April 16-18. Secretary, Joseph W. Richards, Lehigh University, South Bethlehem, Pa.

Iowa Electrical Association. Cedar Rapids, Iowa, April 23-24. Secretary, H. B. Maynard, Waterloo, Iowa.

Iowa Street and Interurban Railway Association. Cedar Rapids, Iowa, April 23-25. Secretary, H. E. Weeks, Davenport, Iowa.

Cleveland Electrical Exposition, May 20-30. Manager, William G. Rose, Wigmore, Coliseum, Cleveland, O.

Association of Railway Telegraph Superintendents. Annual meeting, New Orleans, La., May 19-22. Secretary, P. W. Drew, 112 West Adams Street, Chicago.

Southwestern Electrical and Gas Association. Annual meeting, Galveston, Tex., May 20-23. Secretary, H. S. Cooper, Dallas, Tex.

Missouri Electric, Gas, Street Railway and Waterworks Association. Annual convention, on board steamer *Quincy* en route from St. Louis to Keokuk, Iowa, and return, May 21-23. Secretary, F. D. Beardslee, Union Electric Light & Power Company, St. Louis, Mo.

National District Heating Association. Sixth annual convention, Rochester, N. Y., May 26-28. Secretary D. L. Gaskill, Greenville Electric Light & Power Company, Greenville, O.

National Electric Light Association. Annual convention, Bellevue-Stratford Hotel, Philadelphia, Pa., June 1-5. General Secretary, T. C. Martin, 29 West Thirty-ninth Street, New York, N. Y.

With the Electrical Manufacturers

National Metal Molding Company, Pittsburgh, Pa., announces that its office in Atlanta, Ga., has been moved to the new Healey Building. F. S. Montgomery is southern manager of the company in charge of this office.

Apple Electric Company, Dayton, O., maker of automobile specialties, announces that it will not remove its plant from Dayton, as contemplated. The company has been consolidated with the Splitdorf Electrical Company, of Hoboken, N. J., and the Dayton plant will be enlarged.

The Wagner Electric Manufacturing Company, St. Louis, Mo., announces the opening of a sales office in the Wells Building, Milwaukee, Wis. The office will be in charge of W. Russell Patton, who has for some time been identified with the sale of Wagner apparatus in that territory.

Naugle Pole & Tie Company, 5 South Wabash Avenue, Chicago, is sending out folders showing several views in its extensive Chicago yard and calling attention to its excellent shipping facilities and to the prompt shipments that can be made from the large stocks of poles kept on hand.

The Economy Fuse & Manufacturing Company, of Chicago, has obtained the sole license and exclusive sale of S. & C. extra-high-potential fuses for the Dominion of Canada. The fuses will be manufactured under license in Montreal and all sizes will be ready for delivery March 15.

Machen & Mayer Electrical Manufacturing Company, Philadelphia, Pa., is sending out to contractors and others interested in convenient wiring specialties a circular showing the special clamps which it has devised for use with its Unisectional steel wall boxes. These are arranged to clamp flexible armored cable and for fastening loom in switch boxes.

Chicago Bridge & Iron Works, Throop and 105th Streets, Chicago, Ill., has issued a well illustrated booklet of its steel water towers, standpipes, oil tanks, etc. These are made in a great variety of forms and sizes for various heights of mounting. Although a structural steel tower is used for the support in most cases the tank can also be placed upon a concrete, stone or masonry wall.

The Bryan-Marsh Division of the National Lamp Works of the General Electric Company announces that its Minneapolis office has been removed from 311 First Avenue North to 722-24 Plymouth Building. This change of location was necessitated by the constantly increasing demand for Bryan-Marsh lamps in the northwest, due, in a large measure, to the company's energetic manager, J. L. Barnard.

McIntosh & Seymour Corporation, Auburn, N. Y., has issued bulletin No. 51 describing the types of Diesel oil engines for which it has recently secured the American rights of manufacture. These engines are briefly described and their advantages over other types of prime movers are clearly set forth. The corporation has also issued bulletin No. 52 devoted to its type F horizontal steam engines. These are made either as single cylinder or as tandem-compound or cross-compound machines.

The Nungesser Carbon & Battery Company, Cleveland. O., has ready for distribution catalog No. 5, entitled "Brush Grades." This catalog is supplemental to the previous price list and gives data and information respecting the various grades of carbon, graphite and composition metal brushes upon which the Nungesser company is specializing. Copies of this valuable catalog will be sent to those making proper request and establishing their identity with companies interested in this material.

The Lagonda Manufacturing Company, Springfield, O., has issued a new bulletin on automatic cutoff valves. This publication is an excellent example of the present popular type of engineering catalog, since it is a text of valuable but concise information. It discusses the causes and effects of water hammer in boilers, the effect of cutting in boilers below or above the pressure of the steam header, the specifications of boiler-insurance companies and the methods of government tests. A copy of this bulletin may be had by writing to the company.

Duncan Electric Manufacturing Company, LaFayette, Ind., has issued bulletin No. 28, which deals with its switchboard watt-hour meters. Both direct-current and alternating-current meters are made; the former are either of the series or shunted type and the latter are either of the series type or provided with current transformers and in some cases also with potential transformers. The bulletin describes and illustrates these instruments quite fully, pointing out unique features of the construction and advantages secured thereby.

The Simplex Electric Heating Company, Cambridge, Mass., has been elected a member of "The Rice Leaders of the World Association." A recent announcement states that this association is an affiliation of leading business concerns in America, each representing a different line of industry. It is also stated that an indispensable condition for any concern to qualify for membership is to have builded its business upon the principles of "honor, quality, strength and service." A heraldic emblem has been selected as the combined symbol of these several qualifications.

Pawling & Harnischfeger Company, Milwaukee, Wis., has issued a very attractive publication describing the P. & H. excavator. The booklet is printed upon a fine grade of paper and has exceptionally good half-tone illustrations showing some of the machines in operation for digging various trenches. The construction of the machine is described and its approximate cost of operation given. These machines are equipped with either wheel or caterpillar tractions. They are built in several sizes to meet the various requirements of different classes of work in different localities.

The Lord Manufacturing Company, Bush Terminal No. 7, Brooklyn, N. Y., has ready for distribution bulletin "R" describing and illustrating the "Hydroground" permanent earth contact. This grounding device is made in two types of design—the disk hydroground and the tubular hydroground. The bulletin gives complete information respecting the electrical and mechanical characteristics of both types, and also gives some valuable information relating to the installation of the hydroground and a discussion of grounds in general. Copies of this bulletin will be furnished to those interested upon request.

The Electric Storage Battery Company, Philadelphia, Pa., has issued Handbook IX, devoted to Hyray-Exide battery and switchboard units for small electric plants. These sets comprise a 16-cell storage battery and a switchboard panel complete with switches, ampere-hour meter, and ammeter and rheostat. The whole outfit is shipped in one box and installed with a minimum of trouble so as to be readily connected to the generator and the lighting circuits. Three sizes of battery are supplied, ranging in capacity from 44 to 117 ampere-hours. These sets are particularly suitable in rural districts and other remote places where central-station current is not available.

Safety Insulated Wire & Cable Company, 114 Liberty Street, New York City, has ready for distribution a well illustrated pamphlet entitled "Making One Dollar Do the Work of Two." It describes how the town of Forest Park, Ill., installed an ornamental cluster street-lighting system on one of its main streets at exceptionally low cost by the use of "Safety" steel-taped cable laid directly into the parkway or underneath the brick paving adjoining the curb. This cable is made with one or more conductors of any desired size. Its steel and jute armor eliminates the expense and labor of providing a separate conduit. This type of cable can be laid rapidly in any kind of weather. The cable for the Forest Park installation was supplied through M. B. Austin & Company, 700 West Jackson Boulevard, Chicago, managers of the western department of the Safety Insulated Wire & Cable Company.

Allis-Chalmers Manufacturing Company, Milwaukee, Wis., has had reprinted in attractive form the report on the high-pressure pumping and fire-main system recently installed in Cleveland, O., this report having been prepared originally by the Cleveland Inspection Bureau for the use of fire-insurance companies interested in Cleveland risks. The pumping station contains four electrically driven pump units with a capacity of 2,500 gallons per minute each. The pumps and motors were supplied by the Allis-Chalmers Manufacturing Company. Many illustrations of the pumping station and of test streams are given, also a map showing the district protected.

Record of Electrical Patents.

Issued by the United States Patent Office, February 24, 1914.

1,087,917. Block-Signal System. E. F. Bliss, assignor to Union Switch & Signal Co., Swissvale, Pa. A normal danger block system with special relay control.

1,087,930. Meter for Elastic Fluids. A. R. Dodge, assignor to General Electric Co. Includes an electric motor and controller.

1,087,931. Meter for Measuring the Flow of Fluids. A. R. Dodge, assignor to General Electric Co. The movements of the float are magnetically transmitted to the needle.

1,087,937. Electrolytic Generator. C. Ellis, Montclair, N. J. For generating hydrogen and oxygen.

1,087,950. Electric Generator and Vehicle-Starter. E. L. Jones and C. H. Roth, assignors to Jones Electric Starter Co., Chicago, Ill. A gear and clutch arrangement for connecting the engine and motor-generator when the torque of one machine predominates.

1,087,966. Automatic Control of Signals by Light. W. A. Moffet and R. P. Perkins, San Francisco, Cal. The light rays are projected on a selenium cell which controls an electric circuit to the signal.

1,087,971. Fuse Switch. T. E. Murray and G. W. Christians, New York, N. Y.; said Christians assignor to said Murray. A fuse case with terminal contacts and handle at the end fits into a socket with diverging walls.

1,087,972. Motor-Control System. R. C. Newhouse, assignor to Allis-Chalmers Mfg. Co., Milwaukee, Wis. For an electrically operated dredge or power shovel.

1,087,985. Incandescent-Lamp Suspension. H. R. Sargent, assignor to General Electric Co. A combination porcelain suspension cleat and lamp receptacle.

1,087,997. Electropneumatic Brake. W. V. Turner, assignor to Westinghouse Air Brake Co., Pittsburgh, Pa. Has an electrically controlled valve for supplying air from the signal line to the brake cylinder.

1,087,998. Diagnostic Lamp. R. H. Wappler, assignor to American Cystoscope Makers, New York, N. Y. Comprises an electric lamp and dry cells carried in the handle.

1,088,002. Electrohydraulic Power Appliance. M. C. White and O. C. Duryea, Los Angeles, Cal. An electric motor-driven pump is mounted on a hydraulic riveter.

1,088,003. Resistance Grid. N. Wilkinson, assignor Allis-Chalmers Mfg. Co. Is made of a single resistance conductor bent back and forth, the bends being connected by insulated bolts.

1,088,018. Means for Working Microphones in Parallel. R. Goldschmidt, Berlin, Germany. Mutually inductive current-equalizing choke coils are connected in series with the microphone.

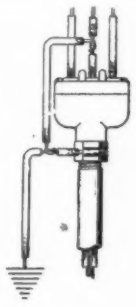
1,088,024. Alarm Device for Automatic Sprinkler Systems. A. C. Johnson, assignor of one-half each to A. A. Carpenter and R. H. Burdick, Chicago, Ill. An electrical alarm.

1,088,092. Portable Machine Saw. M. Reichlinger, Orscholz, Germany. Motor-driven.

1,088,094. Electric Headlight. J. M. Richardson, Highland Park, Mich. The lamp has two filaments, one at the focal center and the other adjacent thereto.

1,088,101. Grounding Device. H. E. Schimmel, Providence, R. I. The neutral wire coming out of the cable end bell and the conduit are grounded. (See cut.)

1,088,114. Unit or Grid. E. C. Van Glahn, assignor to National Electric Utilities Corporation, New York, N. Y.



1,088,101.—Grounding Device.

The coils of the heating element are supported in insulators held by T bars above and below.

1,088,120. Portable Self-Contained Electric Lamp. F. T. Baird, Blue Island, Ill. Turning the bail causes the lamp to protrude and closes its circuit.

1,088,126 and 1,088,127. Winding-Reel for Dynamo-Electric-Machine Coils. M. J. Clark, assignor to Northwestern Electric Co., Chicago, Ill. Comprises a rotatable supporting frame, plates slidably mounted on opposite sides of the frame, and gear mechanism for shifting the plates to bring holding members into and out of alined position with other holding members.

1,088,129. Electrical Recorder. W. H. Cone, assignor to C. E. Bentley, Chicago, Ill. Includes a solenoid-operated rotary type element and an electromagnetically operated printing device co-operating therewith.

1,088,157. Manufacture of Electrical Resistances. A. W. Maley, West Bromwich, England. A rheostat comprising a continuous iron conductor having a carbon content concentrated near the exterior.

1,088,165. Electric Lamp Fixture. T. Nelsen, Chicago, Ill. A bracket with lamp socket set in a recess about which is a globe holder.

1,088,180. Printing Apparatus. H. Querier, Wellington, New Zealand. Has a pair of solenoids beneath the table for positioning any particular die into the line of engagement with the table.

1,088,197. Device on Transformers for Preventing the Decomposition of Oil by the Oxygen Contained in Air. A. Aichele, assignor to Aktiengesellschaft Brown Boveri & Cie, Baden, Switzerland. A horizontally disposed diaphragm of heat-insulating material is supported slightly below the upper surface of the oil.

1,088,210. Storage-Battery Insulation. J. N. Davis, Denver, Colo. A channel-shaped insulation fitting about the lower edges of the grids.

1,088,232. Purification of Water. F. M. Leavitt, assignor to Leavitt-Jackson Engineering Co., Brooklyn, N. Y. Provides electric control for the flow of the purifying gas.

1,088,246. Railway Signaling System. J. B. Struble, assignor to Union Switch & Signal Co. Has special relay control.

1,088,268. Electric Circuit-Breaker and the Like. E. A. Fagerlund, Stockholm, Sweden. Includes a tube containing a liquid, a solenoid surrounding it and a permanent, movable magnet arranged close to the lower part of the tube.

1,088,270. Telephone System. W. A. Fricke, assignor to Monarch Telephone Mfg. Co., Fort Dodge, Iowa. An operator's special test key.

1,088,276. Arc Lamp. J. Harden, assignor to General Electric Co. Has a special clutch arrangement.

1,088,278. Rainguard for Insulators. M. K. Holmes, assignor to Hemingray Glass Co., Muncie, Ind. A centrally perforated plate with a number of inwardly projecting spring fingers to externally embrace the body of the insulator. (See cut, next page.)

1,088,283. Telephone. P. L. Jensen and E. S. Pridham, assignors to Commercial Wireless & Development Co., San Francisco, Cal. Comprises a magnet having an air gap forming a dense magnetic field, a diaphragm, and oscillatory coil forming part of the line circuit and located in the air gap in such a way that it is held rigidly against bodily movement transverse to its axis but is free to oscillate by torsional flexure of the supports.

1,088,296. Electrode. J. W. Richards, South Bethlehem, Pa. Has encircling heat-retarding peripheral recesses.

1,088,311. Electrical Conduit. J. S. Wheeler, Guelph, Ont., Canada. Fibrous ribbon is formed into a tube about which a strip is helically coiled, then both are covered with fabric and saturated with a binding compound.

1,088,327. Accounting System. W. J.

Crumpton, assignor to W. R. Heath, Buffalo, N. Y. Includes electrically driven registers.

1,088,337. Trolley. J. E. Geiger, Kittanning, Pa. A special harp construction.

1,088,343. Process for Making Filaments and Filamentous Plates for Storage-Battery Electrodes. H. C. Hubbell, Newark, N. J. Consists in aggregating a book of alternate layers of different metals, subjecting this to pressure to reduce the materials to thinner layers and applying an eliminating process affecting one set of layers but not the other.

1,088,346. Apparatus for the Production of Gaseous Ozonids. W. J. Knox, New York, N. Y., assignor to Knox Terpezone Co. of America. Includes an ozone generator, a vapor generator and a mixing chamber.

1,088,363. Electric Railway-Signal System. A. Pillich, Lackawanna, N. Y. A block-signal system with circuit-closing devices adapted to be actuated by a passing train.

1,088,366. Unloader for Fluid Compressors. W. Prellwitz, assignor to Ingersoll-Rand Co., New York, N. Y. To insure starting the driving motor with little or no load.

1,088,374. Electric Battery and Accumulator. F. Sablon, assignor to Société Anonyme Electrique de Chumesnil, Chumesnil-Lez-Lille, France. A packing consisting of small fragments of ceramic material to prevent movement of the electrolyte.

1,088,402. Electric Insulating-Fitting. J. F. Burns, Philadelphia, Pa. An insulating bushing including a tube with a number of transverse grooves arranged in staggered relation.

1,088,433. Automatic Time Cutoff. J. Lyle, Longbeach, Cal. An alarm clock releases a trip to open a knife switch.

1,088,451. Mounting for Motors. F. W. Rilance, Thornton Township, Ont., Can. A motor is mounted on a turntable which is prevented from rotating by thumb screws.

1,088,454. Switch-Indicator. C. M. Roe, Jersey City, N. J. An electric signal system so arranged that when any of the tracks is opened by its track switch it operates its signal, cutting out the signals of the successive tracks.

1,088,472. Ignition System for Explosive Engines. C. T. Spicklemire, Wabaningo, Mich. Includes a special reversing switch in the primary circuit.

1,088,489. Self-Regulating Dynamo-Electric Machine. C. A. Vanderwell and A. H. Midgley, Acton Vale, England. Has main and supplementary poles on the field and main and supplementary brushes on the commutator.

1,088,496. Electrical Heating Device for Metallurgical Furnaces. U. Wedge, Ardmore, Pa. Has a series of superposed working chambers with resistance elements in the upper portion thereof to radiate heat downwardly on the material on the hearths.

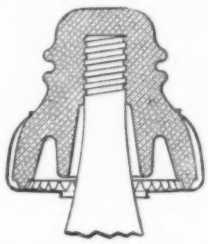
1,088,499. Electromechanical Player for Musical Instruments. J. F. White, Pittsburgh, Pa. An electrically controlled piano player.

1,088,502. Searchlight for Pistols. J. B. Williams, Oakdale, Tenn. An electric lamp and cell are arranged beneath the end of the gun barrel.

1,088,503. Electrical Steering-Gear. J. D. Williamson, Jr., assignor to Williamson Bros. Co., Philadelphia, Pa. Includes an electric motor and special control therefor.

1,088,511. Levitating Apparatus for Starting and Stopping Aeroplanes and the Like. E. Bachelet, Mount Vernon, N. Y., assignor of one-half to M. R. Bracewell. Comprises an aeroplane support, a guideway therefor, and means for producing a periodic magnetic field to levitate the support and aeroplane.

1,088,517. Means for Regulating the Speed of Asynchronous or Induction Motors. J. Bethenod, assignor to Société Alsacienne de Constructions Mecaniques, Belfort, France. Includes a polyphase commutator machine acting as a frequency converter, and an auxiliary machine mechanically coupled therewith, the rotor of the commutator machine having rings connected with the rings of the motor to be regulated.



1,088,278.—Rainguard for Insulators.

1,088,527. Combined Electric-Light System. J. H. Bucham, Danville, Ill. For operating incandescent and arc lamps from the same generator.

1,088,531. Portable Storage-Battery Case. J. A. Callier, Roslyn, Wash. For carrying by a miner in connection with his headlamp.

1,088,541. Automatic Exchange System for the Transmission of Intelligence. F. S. Coulter, Livonia, Ind., assignor of three-tenths to W. F. Guthrie. The exchange mechanism includes a drum with jacks on its interior surface and a rotatable axial shaft carrying cooperating plugs.

1,088,607.—Lamp Stand.

1,088,563. Shoe-Polishing Machine. G. B. Grafton, assignor to Westmoreland Automatic Machine Co., Irwin, Pa. Motor-driven.

1,088,607. Electric-Lamp Stand. W. A. McKay and M. Claussen, assignors to Wizard Electric Lamp Co., San Francisco, Cal. A telescopic stand for an incandescent lamp. (See cut.)

1,088,611. Device for Signalizing the Presence of Explosive Gas Mixtures in Fire-Damp Mines. H. Neubauer, Siebleben, Germany. Includes an explosion chamber, an ignition device and an electric alarm.

1,088,620. Spark Plug. J. J. Platt, Milford, Conn. Has an observation opening in the side.

1,088,648. Circuit-Controlling Lock. T. N. Birch, Kansas City, Mo. The switch is moved longitudinally and laterally by the key of a multitumbler lock.

1,088,657. Reversing and Controlling Gear. J. P. Hall, Oldham, England. Includes a main electric motor, a controller therefor, a motor for driving the controller, a selecting gear for stopping the controller in predetermined position and a slip coupling between the second motor and the controller.

1,088,669. Telephone Support. R. M. Allen, assignor to Western Electric Co. For adjustably holding a desk set on a table or desk.

Patents Expired.

The following United States electrical patents expired March 2, 1914.

577,864. Alternating-Current Arc Lamp. E. R. Knowles, Brooklyn, N. Y.

577,872. Electrical Car-Lighting. M. Moskowitz, Newark, N. J.

577,885. Electric Railway. C. Skinner, Chicago, Ill.

577,911. Automatic Telephone-Call Device. E. P. Boland, New York, N. Y.

577,912. Electric Railway. S. G. Brosius, Baltimore, Md.

577,920. Telephone-Call Register. W. A. Heckard and D. Ogden, Columbus, Ind.

577,950. Double-Pole Reversing Snap Switch. H. A. Gorn, New York, N. Y.

578,001. Current Motor. C. A. Barron, Seattle, Wash.

578,006. Table Telephone Apparatus. L. M. Ericsson, Stockholm, Sweden.

578,016. Commutator Brush. J. F. Kester and F. C. Atherton, Buffalo, N. Y.

578,069. Electric Motor. H. A. Stock, Millersburg, Pa.

578,070. Electrode. A. E. Woolf, New York, N. Y.

578,077. Testing Apparatus for Electric Automatic Systems. C. Burgher, Newton, Mass.

578,107. Electric Lamp. M. M. Kohn, Chicago, Ill.

578,113. Message-Recording Instrument. B. J. Noyes, Boston, Mass.

578,114 and 578,115. Electric Signaling Apparatus. B. J. Noyes.

578,122. Combined Telephone and Annunciator System. J. R. Strong, New York, N. Y.

578,126. Telegraphy. R. H. Weiny, Arlington, N. J.

578,131. Combination Battery Cell. H. A. C. Anderson, New York, N. Y.

578,139. Electric Switch. W. W. Doty, New York, and J. A. MacKnight, Mount Vernon, N. Y.

578,171. Electrolytical Apparatus. C. F. Turner, New York, N. Y.

578,182. Apparatus for Regulating and Modifying Electric Circuits. G. F. C. Adam, Hanover, Germany.

578,233. Electric Arc Lamp. A. Guendel, New York, N. Y.

578,266. Oil, Gas or Like Engine. W. Rowbotham, Birmingham, England.

578,275. Electric Circuit. J. S. Stone, Boston, Mass.

578,280. Dynamo-Electric Machine and Electric Motor. C. P. Turner, New York, N. Y.

578,298. Train-Controlling Device. C. A. Shea, Milton, Mass.

578,304. Electric Rail-Bond. B. J. Iones, Chicago, Ill.

Electric Vehicle Section

TIRES FOR ELECTRIC VEHICLES.

Monthly Meeting of Electric Vehicle Association.

The February meeting of the Electric Vehicle Association of America was held on the evening of February 24, at the Engineering Societies Building, New York City. President Frank W. Smith called the meeting to order at 8:30 p. m., and referred briefly to the action of the Board of Directors in securing permanent headquarters in the building and appointing A. J. Marshall as executive secretary. He then introduced Mr. Marshall, who made a short address referring to the work which had been planned. The Association now has 575 members.

Chairman Becker, of the Committee on Membership, was then called upon, and told of an active campaign being organized, and requested the co-operation of all members.

A paper entitled "The Tire Question as Applied to Electric Vehicles," by F. E. Whitney, was then presented, in the absence of the author, by E. R. Whitney. It was illustrated with lantern slides.

The Tire Question as Applied to Electric Vehicles.

The items affecting the cost of operation of electric vehicles have within the last 10 years undergone changes approximately as follows:

Battery.
Weight reduced .....30 per cent
Capacity increased .....25 per cent
Life increased...50 per cent-150 per cent
Tires.
Life increased.....100 per cent
Cost reduced .....50 per cent
Mechanical Parts: Transmission, gearing, bearings, etc.
Life increased..100 per cent-500 per cent
Weight reduced..30 per cent-50 per cent
Efficiency increased .....50 per cent
Current Rates.
Reduced .....50 per cent-75 per cent

The purpose of this paper is to briefly outline several interesting features noted in studying the tire question and the consequent effect on the performance of the vehicle.

As the data obtained has been confined to tires as applied to trucks and delivery wagons, solid tires only have been considered.

The prevailing types now on the market can be divided into two distinct types, viz.—Endless and Block; and further sub-divided into five classes, viz.:

Class A—Endless, cross wire.

Uniform compound throughout. The rubber at the base reinforced by embedded cross wires and secured to wheel by side flanges or side wire.

Class B—Endless, concentric wire.

Uniform compound throughout, having several wires embedded in the rubber at the base and running around the wheel, secured to wheel by press fit on band and side flanges.

Class C—Endless, hard rubber base.

Soft rubber tread, vulcanized to hard rubber base, which in turn is vulcanized to steel bands which are roughened and dovetailed to secure more permanent attachment. Tire secured to wheel by press fit and side flanges or T-bolts or, as with the case of a number of manufacturers, secured by rings, embodying a demountable feature.

Class D—Block, separate blocks.

Separate blocks secured by cross or side wire and metal cages over blocks bolted through felloes.

Class E—Block, notched tread.

The block effect is secured by V-shaped notches cutting the tread of the tire but the base is left continuous and the method of attachment varies with the manufacturer.

There are reasonable arguments as to the advantages of each class, and as all classes are in general use, there must be merit in each, the general drift at the present time, however, seems to favor the hard rubber base tire.

In selecting tires best suited for any particular case, there are five points to be considered from the point of view of the electric vehicle user, and I place then in the following order:

(1) Efficiency.
(2) Durability.
(3) Resiliency.
(4) Weight.
(5) Cost.

Efficiency is described in mechanics as being the ratio of effect produced to energy expended and with tires the most efficient tire is the one that will roll along the road and offer the least resistance to rolling, the effect of the efficient tires being to reduce the power required to propel the vehicle over the road.

A well designed truck with good tires will show a current consumption of say 35 watts per 1,000 pound mile, and of this total of 35 watts, from 20 to 25 are absorbed in the tires alone, leaving the remaining 15 to 20 distributed between bearings, gearing, motor loss, windage, etc. A change in tires on this same truck could easily increase the current consumption to 50 watts per 1,000-pound mile or in comparison in miles on one charge of the battery the truck in the first case would cover say 50 miles on one charge of the battery, as against 35 in the second case.

From the above it can readily be seen that careful design can easily be offset by an inefficient set of tires; so that if a saving in tire cost per mile is made it is made at the expense of increased current consumption, battery maintenance and reduced efficiency of the vehicle as a whole.

A number of methods have been adopted to test tires for efficiency and there is demand at the present time for a standard method of test, and the establishment of reasonable limits of efficiency. In fact, a number of electric vehicle manufacturers have set standards of their own and are specifying a certain test from the tire manufacturers.

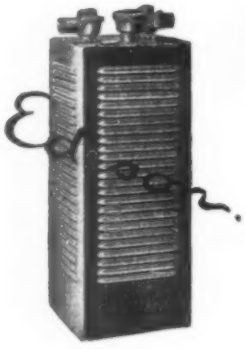
The several methods of test which we have found most satisfactory are as follows:

Bounce Test, which consists in dropping a piece of hard material on the tire from a definite height and measuring the height it will rebound. The proportion of the rebound to the total height will represent the efficiency of the tire, and although this is simply a comparative test, the results secured have been reasonably accurate and the test is quickly taken with tires either on or off the wheel.

Coasting Test.—Allowing the vehicle to coast down a known grade and determining the distance it will run; this being repeated with different makes of tires. The more efficient tire will coast further. This test involves changing wheels and to be accurate should be repeated under identical conditions and one test should follow the other as closely as possible

Running Test, which is made by running the vehicle over a measured course and with proper instruments and stop watch determine the power consumed in terms of watt-hours per ton or 1000-pound mile.

Towing Test, with traction dynamometer. This consists of towing the ve-



In the Blizzards

The Performance of the Edison Storage Battery is its Best Advertisement

DURING the Recent Severe Storms you could see the superiority of the Electric Trucks. Every third one of these Trucks was run by an Edison Battery and every Edison Battery did its duty. A few of the users in the Storm Centers are given below—ask them if they were glad to have Edison Equipment when the Blizzard struck.

NEW YORK

Abraham & Straus.
Adams Express Co.
American Express Co.
Bellevue Hospital.
Bonwit-Teller Co.
Burns Bros.
Charity Organization Society.
H. B. Claflin Co.
Columbia Storage Warehouse.
Dept. of Health.
Geo. Ehret Brewing Co.
General Baking Co.
Gimbel Bros.
Hammacher, Schlemmer & Co.
James A. Hearn & Son.
S. Lichmann's Sons Brewing Co.
Frederick Loeser & Co.
Lord & Taylor.
R. H. Macy & Co.
Mills & Gibb.
N. Y. Edison Co.
Public Library.
Jacob Ruppert.
F. & M. Schaeffer.
Franklin Simon & Co.
David Stevenson Brewing Co.
Tiffany & Co.
Ward Bread Co.

CHICAGO

American Posting Service.
Armour & Co.
Blue Valley Creamery.
Boston Store.
Carson, Pirie, Scott & Co.
Case & Martin Co.
Cluett, Peabody & Son.
Commonwealth Edison Co.
A. Dickinson Co.
The Fair.
H. J. Heinz Co.
Manhattan Brewing Co.
Mandel Brothers.
Marshall Field & Co.
Pilsen Brewing Co.
Jos. T. Ryerson & Sons.
Schoenhofen Brewing Co.
John R. Thompson.
Western Electric Co.
Western News Co.

BOSTON

American Express Co.
Boston Terminal Co.
Brown & Wales.
Burkhart Brewing Co.
Edison Electric Illuminating Co.
Haffenreffer & Co.
Houghton & Dutton.
N. Y., N. H. & H. Railroad.
North Provision & Packing Co.
Old Colony Trust Co.
Thompson & Norris Co.
J. C. Thornton & Co.
Turner Center Creamery Co.
Central Ice Mfg. Co.
N. E. Telephone & Telegraph Co.

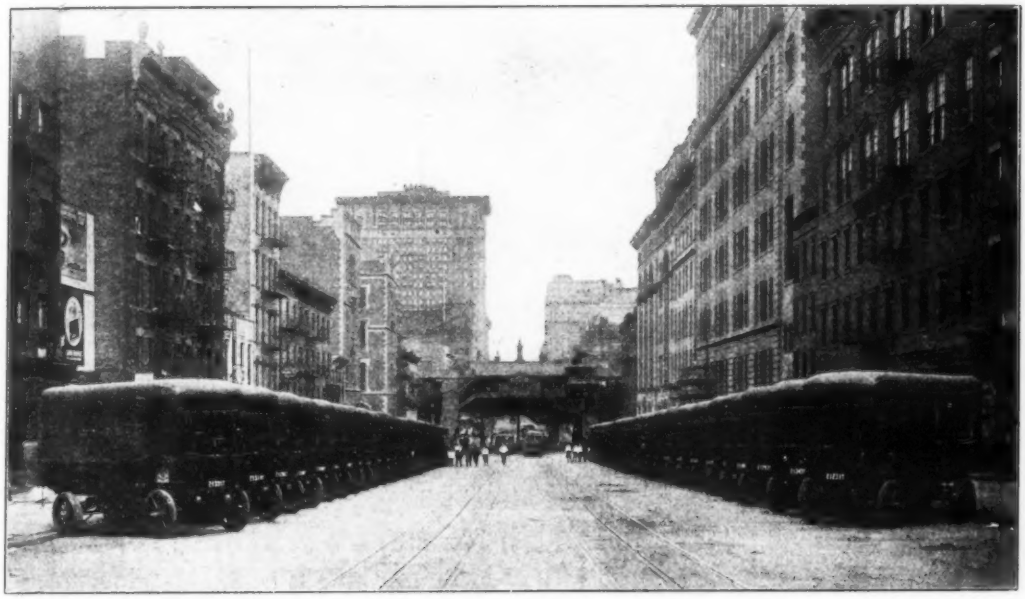
THE EDISON BATTERY did not buckle its plates when the extra load came on because you can even short circuit an Edison without injuring it. The Edison Battery had no broken jars because its steel container is practically unbreakable. The Edison Battery was not injured by too rapid charging to take care of the increased current demand because the Edison may be "boosted" at 5 times its normal charging rate for short periods without harm. In fact there were no battery troubles to put an Edison out of commission immediately or so distintegrate its elements as to materially shorten its life. If you will learn how it is made you will see why this was so. We have an interesting booklet on the subject that is yours for the asking.

Edison Storage Battery Co.

105 Lakeside Avenue, ORANGE, NEW JERSEY

CHICAGO ADDRESS: 2025 Michigan Avenue

Take New York for Instance



A Fleet of "Electrics" owned and operated by The American Express Co.

This is a photograph of a fleet of electric delivery wagons in the service of The American Express Co. in New York City. This company operates in New York 84 Electric Vehicles equipped with "Ironclad-Exide" Batteries. The National Express Co. has 11 "Electrics," and the Westcott Express Co. has 15 "Electrics" in New York City equipped with "Ironclad-Exide" Batteries.

The Jacob Ruppert Brewing Co., of New York City, one of the largest users of electric trucks in New York, has 23 trucks equipped with "Ironclad-Exide" Batteries and 12 trucks equipped with "Exide" Batteries.

George Ehret, another of the largest brewers in New York City, and one of the first brewing companies to adopt "Electrics", has 19 trucks equipped with "Ironclad-Exide" Batteries.

The Central Brewing Co.; Lower's V. Gambrinus Brewing Co.; Bernheimer & Schwartz; Otto Huber—these are other brewers in New York City using various types of "Exide" Batteries.

The New York Edison Company has 110 electric vehicles equipped with various types of the "Exide" Batteries.

The United Electric Light & Power Co., of New York City, operates 7 "Electrics" of varying capacities, equipped with the "Ironclad-Exide" Battery.

New York City has hundreds of other electric vehicle users—both commercial and pleasure—who are receiving excellent service from either "Exide" "Hycap-Exide" "Thin-Exide" or "Ironclad-Exide" Batteries.

Central Stations interested in increasing the use of Electric Vehicles will find that it pays to endorse the "Exide" Batteries.

THE ELECTRIC STORAGE BATTERY CO.

Manufacturer of

The "Chloride Accumulator" The "Tudor Accumulator"

The "Exide" "Hycap-Exide" "Thin-Exide" and "Ironclad-Exide" Batteries

New York Boston Chicago **PHILADELPHIA, PA.** Denver San Francisco Seattle
St. Louis Cleveland Atlanta Detroit **1888-1914** Los Angeles Portland, Ore. Toronto
886 "Exide" Distributors 9 "Exide" Depots "Exide" Inspection Corps

hicle over a definite course in both directions and observing the draw bar pull required. This is an accurate test and is easily taken, but has the disadvantage of requiring the second vehicle and more men.

Dynamometer Test, which consists in mounting the tire to be tested and rolling it against a steel tired wheel, the resistance to rolling being determined in pounds at various speeds and pressures.

The question of durability is important as the cost of laying up a truck to have tire changes made involves considerable expense as well as inconveniences. For this reason a high-priced tire that will run 10,000 miles is a decidedly better proposition than a tire costing 20 per cent less which will only give 8,000 miles of service.

Resiliency is elasticity and although frequently used as referring to tire efficiency, indicates the amount the tire will depress under a given load and its value is in the cushioning effect.

The amount of cushion which the tire interposes between the wheel and the road is an important factor in the value of the tire as measuring the amount of injurious vibration and shocks which are absorbed. In order to determine this effect tires were given various loads and observations taken of the compression of the tire; also of the area in contact with the road.

From these observations curves have been plotted showing the load characteristics of various makes of tires and also the contact with the road, and the load per square inch of the surface in contact.

Fig. 1 shows a series of curves in which the deflection of the tire in sixty-fourths of an inch is plotted agains load in pounds. This test is made by pressing the tire between two parallel surfaces and simply measuring the compression in inches. It will be noted that on curve 3 with a load of 1,250 pounds a compression of 16-64ths is shown, as against 24-64ths on curve 4. In other words, on a bump, tire 4 will compress 50 per cent more than tire 3, and, consequently, absorb proportionately more vibration.

In Fig. 2 area in square inches is plotted against load in pounds.

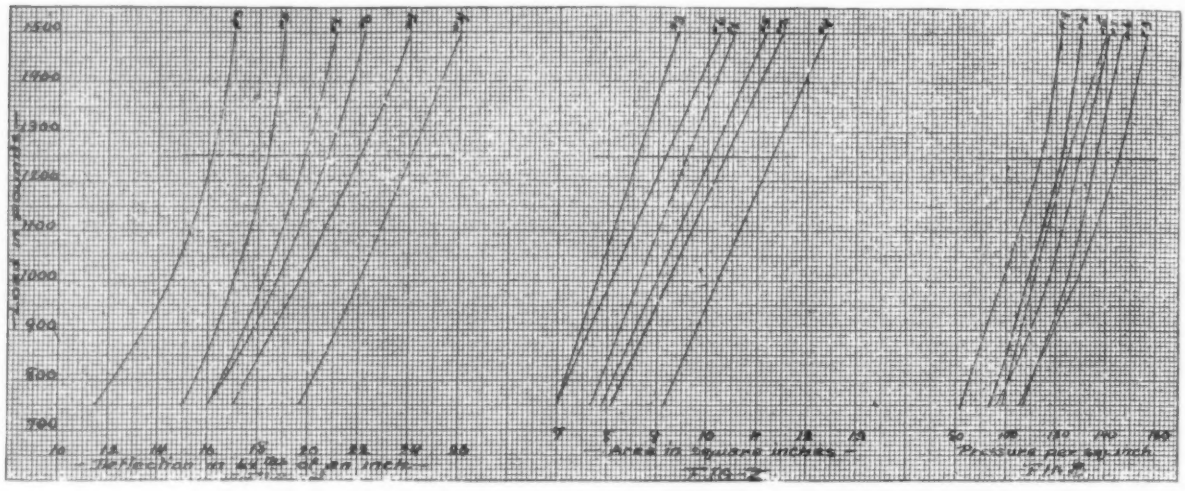


Fig. 1.—Deflection in Tire.

Fig. 2.—Area of Contact.

Fig. 3.—Cushioning Effect.

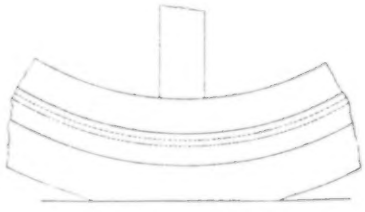


Fig. 4.—Shape of Tire Under Load.

In Fig. 3 pressure per square inch is plotted against load in pounds.

It will be noted that the area in contact with the road varies with the different makes of tires from 8 six-tenths to 11 three-tenths square inches. This, however, does not indicate much unless the pressure per square inch is taken into consideration.

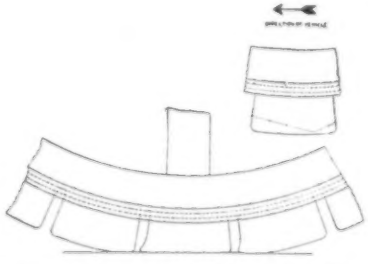


Fig. 5.—Effect Obtained with Block Tires.

Pneumatic tires are usually worked at about 75 to 90 pounds per square inch. It will be noted by Fig. 3 that at 1,250 pounds, solid tires are working at pressures of from 115 to 145 pounds per square inch. The wear on the solid rubber and the service it has to perform are considerably more severe than in the case of pneumatic tires.

Referring to Fig. 1, it will be noted by curve 4 from the direction of the curve that at even 1,500 pounds the tire has not reached its full capacity, whereas on curve 3 the deflection is not increasing in proportion to the added weight and consequently this tire is close to its carrying capacity. This shows that although the tires all have the same rating there is a decided difference in the actual carrying capacity.

Fig. 3 shows an interesting comparison. The first two curves are taken from Fig. 1 as showing tires of about the usual grade of rubber. The lower curve, however, shows test taken on a very soft tire which showed a deflection under load of from two to three times the usual amount. The cushioning of these tires was splendid and the vehicle rode as nicely as if on pneumatic tires, but the shape of the curve indicates that this tire is badly overloaded which actually proved out in this particular case.

Fig. 4 is made to show the shape of tires under load. It will be noted that there is a slight wave in the rubber at both the front and the back of the area of contact with the ground. When the vehice is moving this wave is in front and of increased height.

Fig. 5 shows the effect which is obtained with block tires. It is interesting to note that usually the first idea is that the heel of the blocks is worn out first but as a mater of fact, the toe is worn more on account of its creeping out from under the load as the wheel revolves. The dotted line indicates the

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shape the blocks assume after having been in service for some time.

It is frequently contended that block tires eliminate the wave in front and consequently are more efficient than endless tires. This is a fallacy, however, as the wave instead of being continuous, is broken by each block and very careful tests for efficiency have shown conclusively that with rubber of the same compound the efficiency test is the same.

The question of weight is usually given consideration by the vehicle manufacturer, but the tire manufacturer and the user do not seem to appreciate the importance of reduction in weight, as is evidenced by the fact that practically all of the tire manufacturers in producing their hard base designs have applied an intermediate band to the wheel, simply for the purpose of securing the tire, although the added weight from this band on a set of wheels for a five-ton truck amounts to approximately 400 pounds, and the cost of hauling this 400 pounds—which is approximately 2.5 per cent of the weight of the truck carrying average load—around for one year amounts to $40.00.

As President Smith had to leave early Day Baker was called to the chair to preside during the discussion. He called first upon representatives of the tire manufacturers, Messrs. Swander, Westlake, Phillips and Ashwell, who readily admitted that Mr. Whitney has pursued tests of tires further than the manufacturers. Mr. Ashwell stated that the factories were now alive, however, to the importance of efficiency and were developing along that line. He asked a number of questions which brought out the following information from Mr. Whitney. It is easy to segregate the losses of energy due to the tires and to the other elements of a truck. The results with worn tires are not uniform; some retain their initial qualities and some do not. There is not much variation in a batch of new tires made from the same compound, but tires of the same make do show differences. Little is known regarding the changes which the tire compound undergoes with age; some change but little, while others change a great deal, especially if unused.

Mr. Phillips explained the reason for the steel band on the wheel with some tires, and told of a test on two tires which differed greatly when new, but approached equality when half worn out.

W. P. Kennedy explained the work of the Society of Automobile Engineers in endeavoring to standardize wheel sizes. In a few years there will probably be only two sizes of wheels used on trucks, 36 inches and 40 inches.

Others joining in the discussion were Messrs. Sweeny, Stevens, Duck, Smith, Curtis, Lloyd and Howland.

Mr. Duck and Mr. Baker told of the proposal in Massachusetts to make the license fee for motor trucks proportional to the tonnage, and of the hearing on the bill, which was opposed by nearly everybody except the highway commissioners. The Committee on Roads and Bridges, which has charge of the measure, has not yet reported. The same question will soon come up in New York and all should co-operate to oppose it as class legislation.

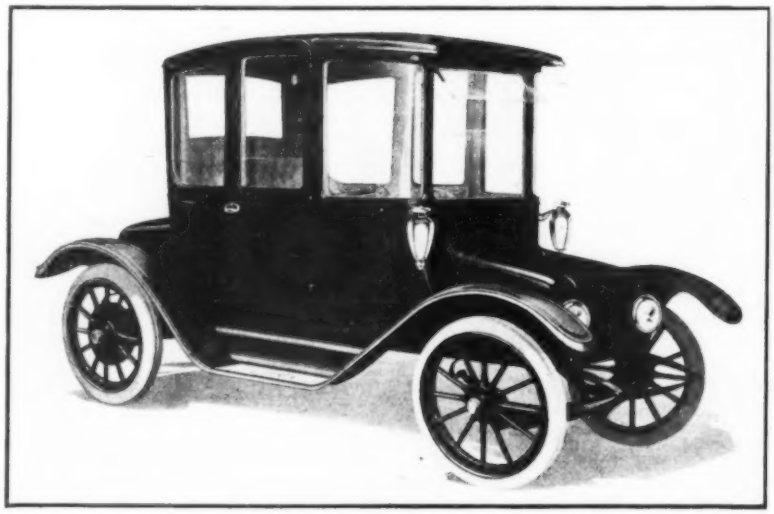
Mr. Pardee said that a law was passed in Ohio making the fee dependent upon the horsepower of the motor. It was $5 up to 12 horsepower, with a surtax running up to $30. The automobile clubs secured an injunction against its enforcement. In Michigan a similar law was passed, and in order to make it valid, the personal tax on automobiles was repealed. This has aroused opposition in Detroit, as the state now gets the fee instead of the city getting the tax.

In closing the meeting, Mr. Baker announced that the Electric Motor Car Club of Boston was to celebrate its third anniversary on March 3 and invited all to be present.

New Model Woods Electric Car.

Among the electric vehicles that aroused great attention at the recent Chicago Automobile Show was a new model developed by the Woods Motor Vehicle Company, of Chicago. The manufacturer of this car claims it to be fully a year ahead of present practice in electric car design and construction. The illustration herewith gives a general idea of the exceptionally graceful lines of the exterior. The outlines of the car are of pleasing, swinging curves; even the corners of the windows are rounded. The front and rear battery hoods have been merged with the body design in a stream-like effect. The fenders are made with long sweeping curves and crowned tops. The body of the car is hung low and the doors are wide and high with a neatly arched top.

In the running gear and chassis construction of this car a number of new ideas have been incorporated. The drive is through worm gear of the Hindley type which is extensively used by one of the best known English car builders. The worm is so mounted beneath the axle as to insure thorough lubrication by means of a forced circulation of oil through the worm and between the bearings. A feature of the chassis construction is the use of a subframe which carries the batteries and motor. Radius rods attached to the rear axle and extending to the chassis frame support the rear springs, thus giving them a leverage, which it is claimed makes the car an exceptionally easy-riding vehicle. Full elliptic springs are used.



New Model Woods Electric Car.

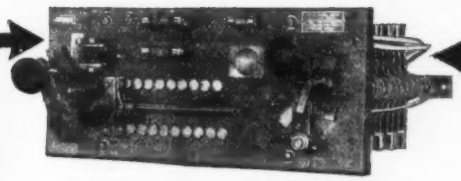
The interior of the car comprises everything that may be desired by the most fastidious taste. The seats are very roomy, the upholstery is soft and deep and the revolving chairs used in the front of the car are unusually large and comfortable.

The company states that it has prepared four types of the car described above; one has dual control from either front or rear seat, another is controlled from the front seat only, a third is driven from the rear seat only and has large revolving chairs in front, and the fourth is controlled from the rear seat and has a single long seat in front.

CUTLER-HAMMER

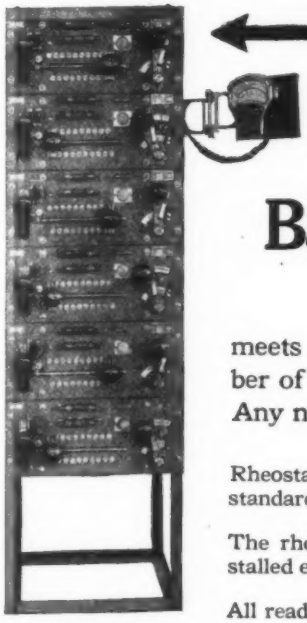
Provide for Future Growth

The latest development of the Cutler-Hammer engineers—the Unit Type Battery Charging Rheostats, can be assembled like a sectional bookcase. Whether you install a big outfit or a few rheostats at a time, the final result will be the same.



EACH SECTION A COMPLETE UNIT

Each charging rheostat with its resistance is a complete, easily handled unit, 24 in. wide, 10 in. high and 20 in. deep. New sections can be added as easily as sections of a sectional bookcase.



Six Unit Type charging sections mounted on standard frame.

New Universal Unit Type Battery Charging Equipment

(The Sectional Bookcase Idea)

meets the requirements of the small and large garage alike. Any number of single charging units up to six can be mounted on a standard frame. Any number of frames can be mounted side by side.

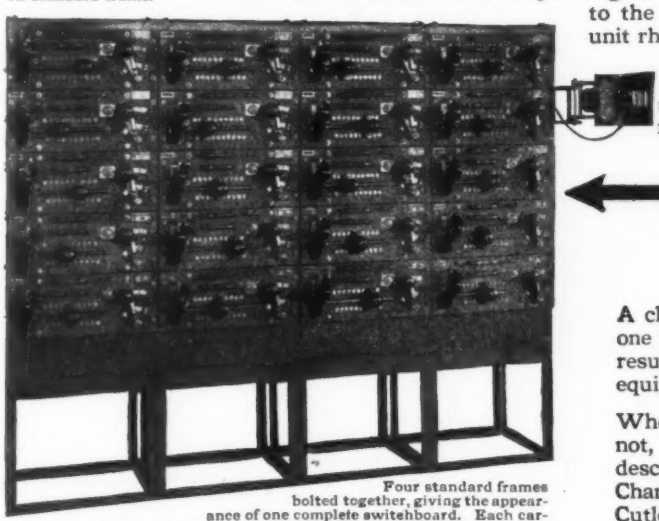
Rheostats or frames can be added like sections of a sectional bookcase. Everything is standardized and every convenience—every safeguard—is provided.

The rheostats are all within easy reach for operation without rods. They can be installed easily and quickly, and the connection arrangements on the back are very simple.

All readings may be taken without opening the charging circuit.

There is no chance of error in operating the wrong rheostat as the sliding handle is adjacent to the controlling switch of the rheostat and each unit rheostat is complete in itself.

The result of our long experience in the design of charging rheostats is expressed in this new unit type charging equipment.



Four standard frames bolted together, giving the appearance of one complete switchboard. Each carries five charging sections mounted with a blank space for another at the bottom.

Additions Easily Made

A charging outfit of several panels may be installed at one time or during the course of several years. The result will be the same. You will have a uniform equipment installed in the smallest possible space.

Whether you need battery charging equipment now or not, you should have a copy of Bulletin 8530 which describes and illustrates this new Universal Unit Type Charging Equipment, the latest development of the Cutler-Hammer engineers.

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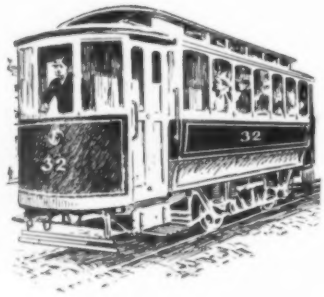

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